ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LIV, No. 13. CHICAGO, SATURDAY, MARCH 27, 1909. ISSUED WEEKLY

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY.
CHARLES W. PRICE, President.
H. S. TUTHILL, Secretary. PHILIP S. DODD, Manager.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: 204 DEARBORN STREET, CHICAGO.

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall.

A. A. GRAY, Managing Editor.

The present publication comprises: ELECTRICAL REVIEW, VOL. LIV, No. 13; WESTERN ELECTRICIAN, VOL. XLIV, No. 13.

SUBSCRIPTIONS

One Year, United States	$3.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

Changes of address reaching this office later than Monday cannot be made until the issue next following.

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

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CONSTRUCTIVE VERSUS DESTRUCTIVE CRITICISM.

The Puritans in the Colony of Massachusetts Bay applied principles of law, developed under generations of monarchies and directly received from the Romans by the thrones of Europe before the Middle Ages, to the principles of local self-government. They formed the town meeting, which was an assembly for the purpose of conferring together, and then from established facts decided what was to be done.

The element which was thus introduced into the town meeting was virtually the power of decision by the people at large, and this development of the affairs of individual decision has advanced from generation to generation until it has permeated the whole body politic, developing a spirit of constructive criticism essential to the establishment of improvements which could not otherwise have been initiated.

Great as has been the development of the spirit of criticism from this shore settlement of 275 years ago, the spirit of criticism is frequently indicated by its analytical, rather than constructive, character.

There is no matter of public information which does not receive public criticism; whether the person is possessed with information of the facts, which would otherwise afford him the right to offer such criticism, being, very often, beside the question. Such critics, it would seem, are frequently deserving of the apostrophe which Carlyle made to Voltaire: "It is true you swing the torch for burning old abuses; but where, O where, do you wield the hammer for building new reforms?"

The basic principle of economy which furnishes people with the luxuries of modern civilization is the growth of the commercial unit, and this has progressed in the face of the directly disadvantageous conditions of increase in the price of labor, and also conceding that raw material of one process may be furnished as a product of some preliminary processes. This increase in the price of labor is mentioned only to show the skill of organization which has increased the production of labor at a greater rate than the increase in wages.

This diminution of price is shown in every expense of a staple which is large enough to be the subject of collective effort. For example, the price of transportation has diminished in a mileage rate of sixty per cent in half a century; to which should be added a greater credit for the speed of transportation.

Illumination, by gas or electricity, has gone down in price and increased in efficiency; particularly with electric lighting, so that in addition to the luxury of illumination, it is possible to carry on many of the higher industries under artificial

illumination which were formerly limited to the hours of natural sunlight and in such locations as were unobstructed by the shadows of other buildings.

Electric transmission of power from the large unit has diminished the cost of power to small users over seventy-five per cent, as is shown by careful examinations of all of the elements contributing to the cost of independent prime movers in small units, while other predominant conditions in the transmission of power has reached such commercial improvements that the large consumers of power cannot afford to use other methods of transmission in new work.

In the manufacture of textiles the cost of plain cotton cloth has diminished to less than one-ninth that received for the first machine-made cloth in this country. Hours of labor have diminished, wages have increased, cotton has been reduced slightly, but the efficiency of the large industrial unit has outstripped all in the establishment of the final economy.

Facts like the above, in which these domestic instances within the personal knowledge of most anyone, have been cited as showing the beneficial results which have accompanied the increase of the industrial unit.

The continuous operation of these large enterprises must be assured; their conduct demands a wider range than is within the skill of any one being, and their operation cannot be at the hazard of a single life. The man may die; the corporation must go ahead without disruption by the Probate Court.

The amount of capital required is beyond the exercise of the most opulent, and therefore, for any of the large industries, capital has become a collective noun, the corporate stock is really an industrial savings bank, the stockholders generally outnumber the employes, and many on the stock ledger are also on the pay-roll.

The amount of responsibility for the management of these enterprises is something which cannot be entrusted to any but those competent for the position; and as learning was maintained through the Middle Ages by the doctrine of selection of competent leaders in the church, while thrones fed by inheritance tottered and fell, the leaders of these corporations are developed by selection from those experienced in their methods.

It is but just and right that those in charge should give account of their stewardship in the forms prescribed by law in order that the thousands who are interested in the final welfare may have information by which to judge their own interests.

It has been our endeavor to avoid any statements subject to controversy in the above. There may be questions of that nature involved in the industrial problems of the country, but they are not salient points. There is one resultant question which reaches to the welfare of the thousands and thousands of provident people who choose this method of investment for their savings, and this is why this class of business enterprise should be the subject of attacks.

The effect of calling a dog a bad name applies equally well to any invested capital, either by the impairment of the price of securities to far below their legitimate market value or the prevention of additional capital to carry on improvements of great value to some local district, as has occurred in the cases of railroads.

During the past year thirteen states have passed valued railroad rates, and it has been said, without contradiction, that there is no evidence of a single instance of an investigation of the cost of transportation preliminary to such legislation. Transfers have been ordered on electric railroads under conditions which have changed prosperous corporations to the most impecunious conditions, with officers helplessly waiting, like Micawber, for something to turn up. Electric lighting companies established by local capital, invested in the spirit of enterprise, have been paralyzed by rates enacted with the intrepidity of ignorance.

All of these changes are felt first upon the labor employed by the thousands by these enterprises, by the persons who have invested their savings in its stock, by the character of the service which must be furnished at such a low price as to prevent the adoption of improvements.

Is it not time for the American people to revert to the fundamental condition of the town meeting of the old colony of Massachusetts Bay, and to consider, and to confer upon these questions in their generality as applying to all, and specifically reach to the industries, and to those skilled in machinery, to those prudent in their savings, and ask if in connection with the proper exercise of legal supervision for the protection of the rights of all, that supervision should be protective, and not libelous, and even destructive.

THE CHICAGO SUBWAY.

The local transportation committee has issued a voluminous report on the engineering and economic features of an extensive subway system for the city of Chicago. It is proposed to construct the subway of such a size that a good share of the traffic now enjoyed by the elevated and surface lines may be diverted to certain sections of the tunnel system. Provisions are made for pipe galleries and conduit systems, and it is suggested that the present network of the utilities corporations be not disturbed during the construction work. Outside of the cost of damages to the foundations of buildings and subsequent reconstruction, the cost of building the subways is estimated about $4,000,000 per mile for the four-track subways; $3,375,000 per mile for the three-track subways; $3,000,000 per mile for the two-track subways, and $800,000 per mile for the one-track tunnels.

According to the statements of the chairman of the transportation committee, there is available about $8,000,000 to begin initial construction, and it is expected that efforts will be made to push the work forward as soon as the new Council is organized. The city's share of the transportation receipts last year amounted to over $1,500,000, and a like amount is due shortly. Under the ordinances the traction companies are pledged to pay $5,000,000 toward the expenses of building the subways, and its projectors are thus sanguine of an early start being made.

THE RELATION OF CENTRAL STATIONS TO THE AUTOMOBILE BUSINESS.

In line with the renewed activity which is taking place in all forms of business, makers of electric vehicles, storage-battery manufacturers and central-station managers are awakening to the possibilities of increasing the use of the electric vehicle, expanding the utilization of the vehicle storage battery and bringing to the central station a profitable line of business in charging the batteries.

It has been said repeatedly that the only thing which has stood in the way of a more extended use of the electric vehicle was the lack of co-operation between the various interests involved in its production. Quite spontaneously all over the country there has arisen a recognition of the necessity and utility of such co-operation, and already an organization has been started in New England bringing together the storage-battery manufacturers, the electric-vehicle builders and the other interests having to do with the construction of motors and kindred appliances. A similar association has been organized on the Pacific Coast, and on Monday of next week there will be a session of engineers, manufacturers and central-station managers in Cleveland to discuss the relations of the central stations to the automobile business. Another meeting will be held in Chicago on March 31, and a very interesting discussion is assured by virtue of the quality of the papers and the standing of the authors already announced.

The success with which the efforts of several large central stations to build up a profitable off-peak business in the charging of batteries on electric vehicles has been attended, has encouraged others to look into its possibilities. Information is being sought, and the impetus which the initial efforts at co-operation has received, will undoubtedly carry the work forward in rapid fashion.

The general practice at the present time is to provide garages large enough to handle the apparent demand and charge the batteries during the period when the demand for power and light is low, offering a reasonable charge for this service in order to secure the business. Even with the investment necessary for a suitable site and sheds to house the vehicles, the proposition of keeping the generating machines busy when they would otherwise be more or less idle, has been an attractive one. This field, however, is full of possibilities, and it is quite within reason to expect that, with the electric-vehicle manufacturers and the storage-battery makers working hand in hand, it will in time be just as easy for the owner of an electric vehicle to check a set of batteries and have them charged, calling for them when he may find it necessary, as it is at present to check a trunk or a piece of luggage. Of course, there are many constructional difficulties in the way of this condition at present, but it is not entirely illogical to express the hope that the advantages to be gained in decreased maintenance due to the better handling of the batteries and the facilities which can be developed for eliminating from the electric vehicle uncertainties of operation and bills for repairs that it will become the most popular type of horseless vehicle for city use.

ILLINOIS FUEL CONFERENCE.

The United States Geological Survey has been carrying on some important work in connection with developing methods and appliances which will render the practice of coal mining less dangerous to the miners and more profitable to the operators. In conjunction with the Survey, the Illinois State Geological Survey and the University of Illinois held a conference recently at Urbana, marking the opening of the Urbana Laboratory for Mine Accident and Mine Rescue Work. This laboratory has been established under the direction of the State Geological Survey.

The opening session of the conference was held on the morning of Thursday, March 11, Dr. W. F. M. Goss, Dean of the College of Engineering, presiding. Dr. Goss very briefly outlined the nature of the work undertaken by the co-operating organizations, and responses were made by representatives of the Survey and of the Illinois Coal Operators' Association. A tribute was paid to the work of the scientists who had dreamed and experimented and had brought to the hands of the mine operators many devices which eliminated the accidents which, perforce, were largely the result of ignorance, indifference and lack of foresight.

The work of the conference had another side, which is more directly related to the fuel consumer, and thus of practical importance and benefit to the corporations generating and selling electricity. This departure was in the form of discussions of fuel economy, smoke suppression and the selection of coal for boiler furnaces.

The services of the laboratory are to be extended to those who desire to secure the benefits thereof, covering a great territory in Illinois, Indiana, Western Kentucky, Iowa, Missouri and Michigan. General instruction will be given to mine bosses and tests made of methods of conducting rescue work, and research carried on for the development of appliances which will make for the safer operation of the extensive properties in this locality.

THE MINNESOTA ELECTRICAL ASSOCIATION.

The second annual convention of the Minnesota Electrical Association was held in Minneapolis last week, and, judging from the attendance and the satisfaction derived, the society is a success and has before it a decidedly useful future. The papers presented were of considerable practical benefit to the central-station managers, and among other matters discussed the subject of methods of building up day loads in small central stations received considerable attention. So many devices for use in the home and the shop have been placed on the market by the enterprising manufacturers, that at present the central-station manager has an opportunity of building up a profitable day load which never existed before. The meetings of the State associations are valuable in thus bringing to the attention of the central stations the success which has attended the efforts of those who have made the initial experiments.

Tungsten incandescent lamps came in for a generous share of the discussion, and there was also an interesting paper on buying coal on the basis of its calorific value.

The Chicago Subway Report.

The report of the Chicago City Council transportation committee, comprising three big volumes, containing charts, tables and maps, as well as a critical analysis of the conditions in the city and the probable growth of its population during the last half-century, have been made public. The analysis of the report is made by Alderman Milton J. Foreman, chairman of the local transportation committee, and the work has been prepared by City Engineer John Erickson, Commissioner of Public Works Hanberg and Special Assistant Engineer Thomas S. Johnston. The map published herewith will give a clear understanding of the conclusion of the investigators as to the initial construction work to be undertaken. The report makes the following suggestions:

"The study of the transportation problem has brought forth the suggestion that it will be desirable to first construct four track subways or their equivalent north and south at the eastern margin of the city, extending from the vicinity of Chicago avenue and Orleans street to the vicinity of State and Twenty-second streets, and following this, or contemporaneously with it, to construct other subways extending easterly from the vicinity of Halsted street and Blue Island avenue to the eastern margin of the city; then northerly to streets just south of the main river, and thence westerly to the vicinity of Halsted and Lake streets. Further, to establish four subway outlets or terminals—one in the vicinity of State and Twenty-second streets; one in the vicinity of Chicago avenue and Orleans street; the third in the vicinity of Halsted street and Blue Island avenue; and the fourth in the vicinity of Halsted and Lake streets.

"It is suggested that two tracks in the north and south subways might be used for surface lines and two tracks for the elevated lines.

"Trains of the Northwestern Elevated Railway might enter the subway in the vicinity of Chicago avenue and Orleans street and run through to a loop at the outlet in the vicinity of State and Twenty-second streets, returning to the outlet in the vicinity of Chicago avenue and Orleans street, and then proceed to their respective destinations.

"Trains of the South Side Elevated might enter the subway in the vicinity of State and Twenty-second streets, then run through the subways on the tracks used also by the Northwestern Elevated for its trains in the same direction to a loop at the outlet in the vicinity of Chicago avenue and Orleans street; and then returning through the subway, using the same tracks as the Northwestern Elevated trains use, in the same or southerly direction to the outlet in the vicinity of State and Twenty-second streets, and then proceed on the elevated structure to their respective destinations.

"Likewise, the surface cars might be diverted to the subway entrances, using the other two tracks in the subway exclusively, and operated between two outlets in the way similar to that suggested for the operation of the elevated trains.

"It is not intended to divert all the trains of the elevated systems, nor all the cars of the surface lines into the subways, but only a sufficient number to relieve the congestion of the loop district and such additional cars or trains that may be required to handle the passengers desiring to use the subways.

"In commenting on the details of the trial subways the report goes into a description of track and station arrangement, showing its advantages. It continues:

"It will be noted that by the use of the island train platforms, located alternately between the two tracks for the use of the elevated lines, and between the two tracks for the use of the surface lines operating through the subways, maximum efficiency will be obtained at a minimum width of subway. The train platforms are sixteen feet in width and longer than necessary to accommodate two trains of nine cars (one train on each side).

"By designating the exact point of the train platform where trains or cars for certain destinations will stop to load passengers for those destinations, the length of the station stop will be small, which will assist in approaching the maximum capacity or efficiency of the subway.

"It will be noted also that passengers leaving trains on these different train platforms will have a sufficient number of stairways to ascend conveniently to the train platform galleries (thus avoiding the platform crowd waiting to take trains), and from such galleries they may reach one of the vestibules at each end of the train platform, ascending from there to the street surface by any of the four stairways.

"Included in the subway plans but underneath that part set aside for the use of cars and trains, there has been designed space for the public utilities that are at present buried in the streets and accessible only at great cost and inconvenience to the public.

"The space for utilities has been designated as the 'utilities gallery,' and consists of five compartments, each about eleven feet wide and from six to eight feet high in the clear, located so as to receive sewer, water, gas, telephone, telegraph, electric and other public-service conduits.

"The compartments will be of uniform width, located parallel with the centre lines of streets and separated by lines of columns at intervals of about twelve feet, so access to the utilities will be convenient at all points and at all times.

"The general plan of construction is to maintain a rectangular section, utilizing all the space available between curb walls, the street surface and the general level of the construction of the Illinois Tunnel Company. Variations from this cross-section will, of course, be advisable at entrances to and within tunnels under the river.

"The walls on either side at the curb lines should be constructed of concrete, reinforced with steel, designed to provide for all the loads and pressures within the limits of safe resistance stated in another part of this report, with a minimum occupation of space which is recognized as valuable to occupants on each side.

"Following the completion of side walls, transverse trenches may be opened for the temporary bracing across the street, when the construction of interior footings, transverse girders, and erection of columns may be completed and walls permanently secured prior to the excavating of the main portion of the subway prism.

"A series of three-hinged reinforced concrete arches may be built, affording an unobstructed view from the vestibule of condition of lower platform and movement of trains and a pleasing variation in architectural effect.

"When completed the subway proposed would be practically monolithic, with enduring and non-resonant qualities possessed by no other form of construction.

"It is urged that the service of public utilities ought not to be molested during the construction work.

"The service provided by public utilities located between curb lines and beneath the pavement should not be abandoned during the period of reconstruction.

"Data on existing conduits are as com-

plete as required to develop designs for their temporary maintenance, but the proposed renewals and extensions to provide for future service are not yet determined except for water supply.

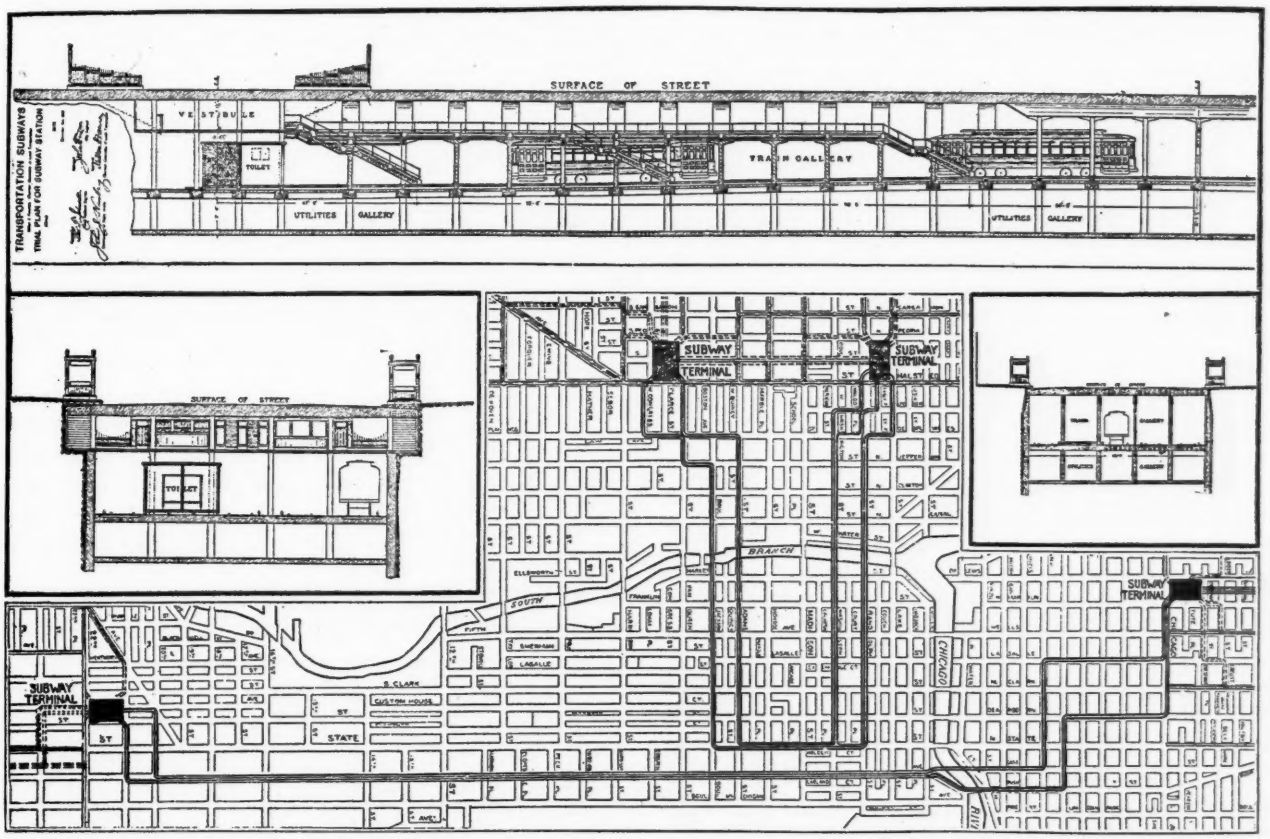
"The sub-sidewalk areas are generally ample and may be utilized temporarily for water, sewer and gas lines, as well as for electric, telephone and telegraph cables, and where sub-sidewalk areas are inadequate the electric conduits may be carried temporarily on overhead construction.

"Figures on the cost of constructing the subways are as follows:

"It is estimated that the cost of making the work at the prices above estimated and without extra charge for caring for building foundations.

"An estimate for caring for building foundations along the north and south line is $200,000 per mile under one form of specifications. It is only in the business district that any considerable costs of this nature will be involved; and while an occasional large building on spread foundations (like the Auditorium) may individually involve much larger expense, it is believed that the cost per mile as estimated, when distributed over the entire proposed line, will not be exceeded.

It is expected that as soon as the new City Council is organized, the work on the $50,000,000 subway system will be started. The question of financing the subway, according to city officials, is a comparatively easy one. Chairman Foreman stated the necessary data are ready, and money is in the bank to begin the work. The city's share of the traction receipts for last year amounted to $1,592,462, and that amount is now in bank; an almost equal amount will be due from the traction companies within the next three weeks, as a second year's installment. Under the ordinances the traction



THE PROPOSED CHICAGO SUBWAY. SECTIONAL STUDIES OF FOUR-TRACK AND SINGLE-TRACK TUNNELS, AND DIAGRAM OF SUBWAY ROUTES.

subways, excepting such costs as will pertain to foundations of buildings, will be as follows:

	Cost per mile.
Four-track subways, as in Wabash Avenue	$3,750,000
Three-track subways, as in Washington Street	3,375,000
Two-track subways, as in Van Buren Street	3,000,000
One-track tunnels, as under the rivers.	800,000

"The cost of taking care of building foundations will depend on the method of procedure in doing the work; it is believed, however, that a specification for doing the work may be drawn under which contractors will agree to execute

KEY
Dotted Lines Are Probable Connections of Subway Terminals with Existing Surface and Elevated Lines
SURFACE LINES
ELEVATED
SUBWAY
PROBABLE CONNECTIONS

"Under the specifications contemplating such expense, the average cost of any east-and-west subway, as far as building foundations are concerned, will necessarily much exceed the same cost for the north-and-south subway; but the routes may be so selected as to avoid the worst cases."

companies are required to furnish $5,000,000 for the building of subways when called upon, so there will be more than $8,000,000 available this year.

A New School for Applied Science in Pittsburg.

It has been announced that Mr. Carnegie has erected the $1,000,000 building for a School of Applied Science which has been added to the group of buildings at the Carnegie Technical Institute, at Pittsburg, Pa.

Hydroelectric Plant of the Schenectady Power Company.

BY C. T. WILKINSON.

The Schenectady Power Company has just completed a 12,000-kilowatt hydroelectric station at Schaghticoke, Rensselaer County, N. Y. This waterpower development is situated on the Hoosic River (see Fig. 1), approximately eighteen miles from Schenectady, twelve miles from Troy and nineteen miles from Albany. This location is within easy reach of some rapidly growing industrial centres; no difficulty, therefore, was experienced in disposing of the power developed; in fact, almost the entire output will be utilized by the General Electric Company at its Schenectady works.

The Hoosic River is one of the most important tributaries of the Hudson, and has its headwaters in the Berkshire Mountains in Massachusetts, from which it flows in a westerly direction, emptying into the Hudson River some two miles north of Mechanicville. Its total drainage area covers some 730 square miles, the drainage area above Schaghticoke being approximately 635 square miles.

The scheme involves an equalizing reservoir and small power station at Johnsonville, and a pondage at Schaghticoke, six miles lower down the stream, which leads by canal to the forebay, some six hundred yards to the northwest, from which the water is led by penstocks across one bend of the Hoosic River over the intervening thousand feet of land to the power station, thence into the river a little below Schaghticoke. (See Figs. 1 and 2.)

For several years back the minimum rainfall obtained in this locality was thirty-one inches, and the average rainfall in this area was thirty-nine inches. This rainfall is well distributed over the whole year.

The climatic conditions, which are of considerable importance, since they determine the strength of structures, the insulation of the line and high-tension apparatus, the maximum expansion and contraction and strains in the metals employed, the liability of interruption by lightning, etc., are very moderate in this district. The maximum wind velocity may be taken as approximately seventy miles per hour, the maximum temperature 100 degrees in the shade, and the minimum temperature as forty degrees below zero. For metallic structures exposed to direct sunlight it is usual to increase the upper temperature limit some twenty degrees. Slight mists and fogs occasionally occur, and their effect on the insulation of the system is, in this case, of only slight importance. Only a moderate number of electric storms are experienced.

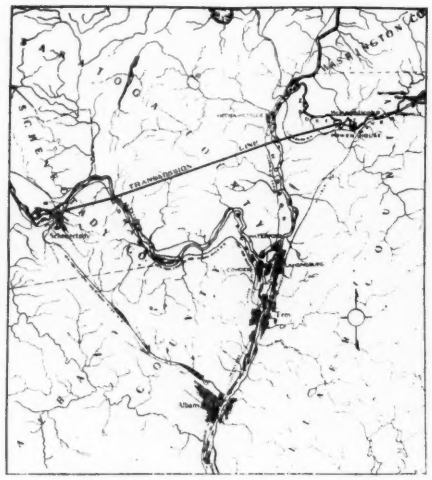


FIG. 1.—MAIN TRANSMISSION LINE.

The transmission line passes over rolling country, and there were experienced no unusual difficulties in construction. The line is not subject to excessive static discharge. The watershed is well timbered, with its resulting effects on the evenness of stream flow, and the reservoirs are situated on clay and gravel soil with hardpan and rock foundations.

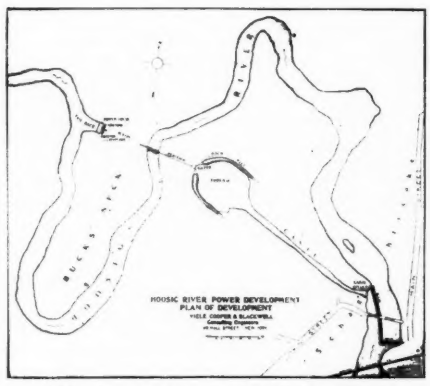


FIG. 2.—PLAN OF DEVELOPMENT.

Storage.—For some years past the minimum stream flow has been 213 second-feet and the maximum 5,680, and the storage capacity provided is sufficient to maintain a discharge of 340 second-feet continuously to the waterwheels.

The Johnsonville storage reservoir has a calculated capacity of 300,000,000 cubic feet of water. This is supplemented by an equalizing pondage obtained by throwing a dam across the river at Schaghticoke, which holds back 25,000,000 cubic feet at the crest of the dam, or 44,000,000 with a three-foot flash-board. The main reservoir at Johnsonville is used to equalize the flow of the river, and does not provide an effective head on the Schaghticoke plant. The head for this plant is provided by the dam at Schaghticoke, and may be taken as an average of 150 feet, which, at extreme high water, may be reduced to 145 feet for short intervals.

Johnsonville Dam.—The Johnsonville dam, Fig. 3, is of the spillway type and built of concrete throughout its approximate length of 500 feet. It has a height of thirty-nine feet, and flash-boards are provided to raise this three feet more when desirable. The dam base is thirty-five feet thick at the point of greatest depth. The flash-boards are made of wood, supported with one-inch Wayne iron pins, placed five feet apart, into sockets of 1.5-inch gas pipe six inches deep.

A small auxiliary power station is situated at the northwest end of the dam. At present this station is in a preliminary stage. When complete it will contain two 1,800-kilowatt, 4,400-volt, three-phase generators. This power station is eighty-five by thirty-eight feet in size and discharges into a dug-out tailrace, separate from the main stream for the first 130 feet, by a concrete diverting wall. The dam has four sluice gates and one ice chute.

Schaghticoke Dam.—The Schaghticoke dam, Figs. 2 and 4, is 736 feet long and runs slantwise across the river. It is twenty-seven feet high at the lower end, twenty-one feet high at the upper end, with a base thickness of 27.5 and 24.5 feet, respectively. The iron bridge joining the two parts of the village of Schaghticoke is supported in the centre of the dam. The dam is situated just below the Boston & Maine Railroad track, and has two sluice gates at the lower end for discharging into the river bed, and eight gates, Fig. 5, which discharge into the

power canal that carries the water some 1,500 feet into the forebay. This canal is dug out of shale and loose earth, and where quicksand was encountered the banks are protected by a wooden crib-work, the construction of which is shown in Fig. 6.

Forebay.—The location of the canal and forebay are shown in Fig. 2. The forebay is horseshoe-shaped and constructed chiefly with earth banks. Some concrete work used at the west end serves to support the ice racks and forms an anchorage for the main penstock, Fig. 7. The racks which protect the penstock from ice and floating matter are shown in Fig. 8. The ice racks are four in number, each seven feet seven inches wide by thirty-six feet nine inches long. The rack bars consist of seven-sixteenths by four-inch iron.

Penstocks.—The penstock, which is very clearly shown in Figs. 9 and 10, is twelve feet six inches in diameter and built of three-eighths-inch steel plating. It runs across the river between the forebay and surge tank, running down the first bank of the stream for 213 feet at an angle of fourteen degrees, then horizontally across the river for 392 feet, then up the opposite bank at an angle of twenty-four degrees for 119 feet, where it is carried in a trench 143 feet to the water tower or surge tank. It is supported across the stream on a steel framework bridge carried on concrete piers, as shown in Fig. 10.

Surge Tank.—A surge tank is provided to protect the hydraulic system against severe shocks, which would occur due to abnormal rise in water pressure, if the power station or individual units were to be suddenly shut off in case of emergency. Fig. 11 shows the approach to the surge tank from the main penstock, and at the right in Fig. 12 can be seen the opposite side of it, from which issue five turbine penstocks. The tank is forty-five feet inside diameter, fifty-six feet high and built of three-eighths-inch riveted steel plates. The coffin valves which operate the turbine feeders are inside the tank and are opened and closed by 250-volt, twenty-nine-ampere, direct-current waterproof motors mounted on a platform on the top of the tank, and operated from the power house.

Turbine Penstocks.—The turbine penstocks or feeders running from the surge tank to the turbines are five in number, and are all constructed of sheet steel. Four of them are six feet in diameter, and supply the main turbines; the fifth is a two-foot pipe supplying the exciter turbines. They are supported by concrete foundations at intervals; suitable expansion joints are also provided. The coffin valves which operate the turbine feeders may be operated either by hand or by motor.

Ice Protection.—In this region ice protection is of very great importance. The

FIG. 3.—CONSTRUCTION OF DAM AND RESERVOIR SITE, SCHENECTADY POWER COMPANY'S SCHAGHTICOKE DEVELOPMENT.

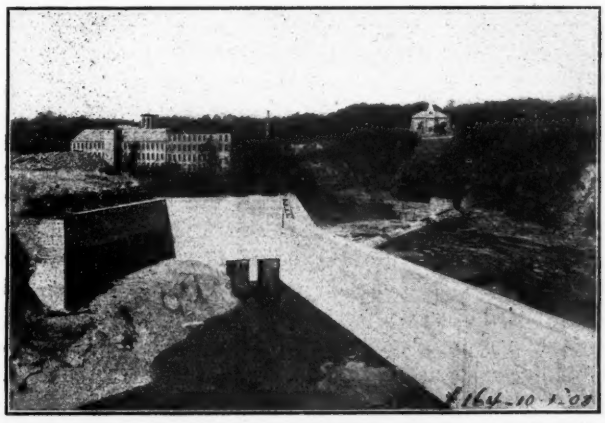


FIG. 4.—LOWER END OF SCHAGHTICOKE DAM, SHOWING SLUICEWAYS AND ENTRANCE GATES TO POWER CANAL.

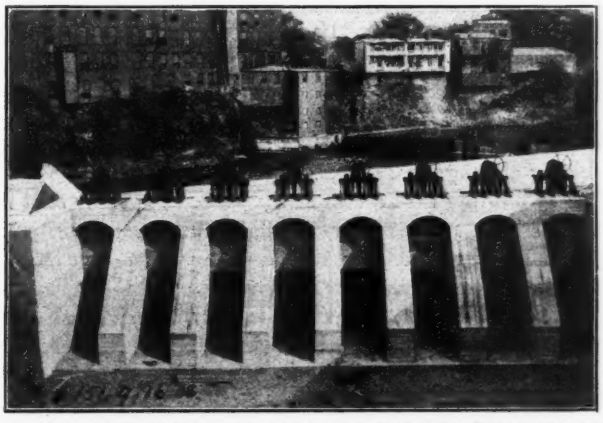


FIG. 5.—ENTRANCE TO POWER CANAL, SHOWING HAND-OPERATED GATES AND SUBMERGED CURTAIN ICE PROTECTION.

methods employed at the Schaghticoke power plant consist of: First, the use of submerged arches at the entrance to the power canal, and second, the ice racks and ice sluiceway at the entrance of the main penstock. At the new development, which is now only in a very preliminary condition, at the upper dam at Johnsonville, the ice protection will consist of submerged arches at the entrance to the forebay and an ice sluiceway.

POWER-STATION BUILDING.

The photographs and sectional views, Figs. 12, 13 and 14, show the general arrangement of the station, and give the chief dimensions. The building is of fireproof construction throughout, with foundations and floor of concrete. The concrete is carried up and forms the first six feet of the wall; the part above this is of hollow-brick construction, a space of some four inches being left between the two thicknesses of the wall with a suitable bonding at intervals. This is of material help in insuring the dryness of the power station. The roof is of book tile with tar and gravel dressing; the doors are all metal covered and the window frames are of steel. The lighting is entirely from the windows on the west and south sides, and ventilation is obtained by two galvanized-iron roof ventilators, which can be opened and closed from the station floor by the attendants.

There is no apparatus below the floor except parts of the wheel casings and two oil tanks at each end of the building. The wheel pits are interconnected and drained into a pit under the exciters at the south end of the station, and the sump being well above the river level, a thorough natural drainage of the basement is obtained.

The two oil tanks above mentioned are for the storage of oil for operating the waterwheel governors and for the supply of the transformers. A small vacuum pump is used for refilling the latter, and the 150-pound pressure which operates the governors is obtained by a Pelton pump driven by a variable-speed, 250-volt, direct-current motor. An air-compressor outfit installed near the oil-pressure pump provides the necessary air for blowing out machinery, etc. Loricated conduit is used for small leads and bituminized fibre for larger leads.

Repairs and changes in apparatus are facilitated by the twenty-ton overhead electric crane, and a repair shop is being fitted up in the north end of the station. An examination of the station plan shows that ample space is allowed for placing large pieces of machinery and for easy examination, adjustment, or repair of all apparatus. It should be noticed that though the transformers are placed in separate closed compartments, entirely closed by steel rolling doors to reduce the fire hazard, yet they can be easily moved in or out of these compartments on rails in the station floor.

The station lighting is obtained from the 110-volt secondaries of transformers connected to the 4,400-volt line in open delta, and emergency lighting is provided in the most important places by the distribution of some forty incandescent lights, which can be thrown on the 250-volt, direct-current exciter circuit.

The 4,400-volt lines from the generators are carried to the low-tension bus-bar compartments situated on the station floor (see Fig. 14), from which leads pass to the transformer compartments, two on either side. The high-tension transformer leads are led out through the top of the transformer compartments to the oil switches, and thence through disconnecting switches to the 32,000-volt buses. The exact location of the more important apparatus is shown in the sectional view, and Fig. 15 shows an end view of the high-tension gallery.

APPARATUS.

Turbines.—The turbines are of the Francis type built by the Pelton Water Wheel Company, and their general arrangement is clearly shown in Figs. 16 and 17. The prime movers are rated at 5,000 horsepower and are of the vertical type, designed to run at a speed of 300 revolutions per minute under a 146-foot head. These main turbines are four in number and, in addition, two 250-horsepower, 600-revolutions-per-minute, horizontal-shaft, single, Pelton-Francis turbines are provided direct-connected to two 150-kilowatt exciters.

FIG. 6.—CONSTRUCTION OF THE WOODEN CRIB-WORK, POWER CANAL.

FIG. 7.—FOREBAY AND MAIN PENSTOCK ANCHORAGE.

The sectional elevation (Fig. 16) of the main turbine shows the casing, distance ring and generator mounted on top of the ring. It will be noticed that the governor is also mounted on this ring, direct-connected to a rock shaft controlling the turbine gates. The brake with which each unit is provided may also be seen. This is used for stopping the set quickly when the water is turned off.

The waterwheel governors at Schaghticoke are of the Pelton type, and at Johnsonville of the Lombard type, and were supplied to meet the following guarantees: They provide for a speed variation not exceeding two per cent with a twenty-five per cent variation in load, four per cent with a fifty per cent variation in load, and ten per cent with a 100 per cent variation in load. They are so arranged that the machines can be thrown in or out, either by hand wheel or by a motor, operated from the switchboard.

Fig. 17 shows very clearly the casing, distance ring and governor with rock-shaft connections and brakes. The main turbine runners are fifty-two inches in diameter. The inlet to the turbine case is fifty-six inches in diameter. The extreme diameter of the case is approximately twenty feet, and the height from the centre of the case to the top of generator shaft about seventeen feet four inches. The weight of each turbine, exclusive of the shaft and generator, is approximately 140,000 pounds. The turbine runners are of bronze, the wicket gates of forged steel, and the water passages between the turbine case and the runner are lined with renewable bronze rings. The turbine runner is bolted to the coupling forged on the end of the generator shaft. This shaft has a steadying bearing above and below, and the entire weight of the generator and turbine is carried on roller bearings revolving in the oil chamber mounted on the top of the generator casing. The total weight supported by the roller bearing is 40,000 pounds. When the turbine is in operation, part of this weight is carried by the upward thrust of the water under the flange on the turbine runner and by the upward thrust due to the reaction of the runner. The control of these turbines is either by hand or by electric motor operated from the switchboard, and the controller mounted on the iron hand rail beside each turbine (see Fig. 13) operates the turbine penstock feeder gates in the surge tank.

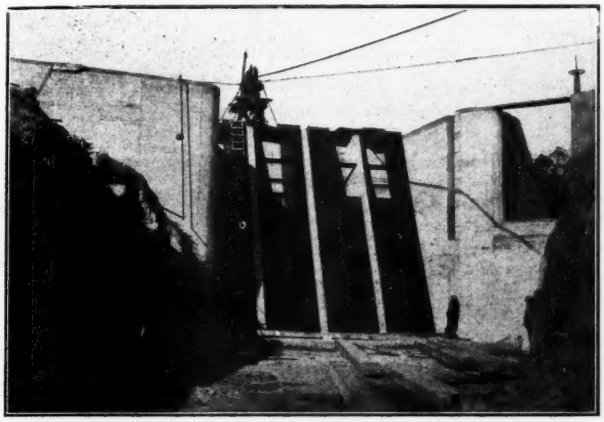


FIG. 8.—ROCK-PROTECTED GATEWAY TO MAIN PENSTOCK.

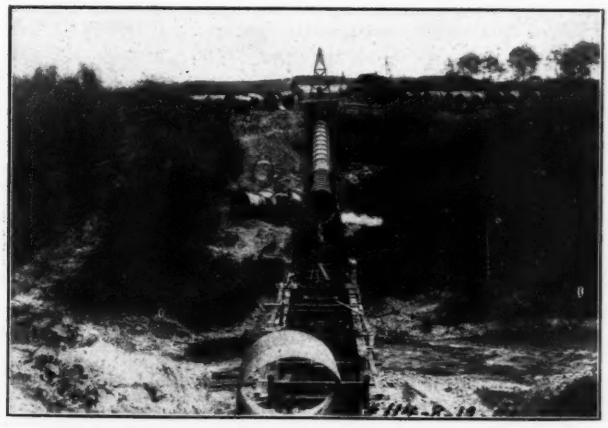


FIG. 9.—CONSTRUCTION OF THE MAIN PENSTOCK.

FIG. 11.—MAIN PENSTOCK AND SURGE TANK.

Generators.—The generators are of the standard General Electric vertical type, with bar-wound armature. The shipping weight of each generator complete, including stator, casing, roller bearing and rotor, was 75,000 pounds. The alternators are of the three-phase, revolving-field type, sixteen-pole, 3,000-kilowatt, 300-revolutions-per-minute, 44,000 volts, forty cycles, are listed as of the type ATB 16-3,000-300 form V, and their efficiencies are as follows:

Load.	*Efficiency.*
100 per cent	96.1 per cent
75 per cent	95.1 per cent
50 per cent	93.6 per cent

The guaranteed regulation is eight per cent for 3,000 kilowatts at unity power-factor.

The heating guarantees are as follows:

Forty degrees C. rise in temperature in any part for continuous operation at 3,000 kilowatts, unity power-factor. Fifty-five

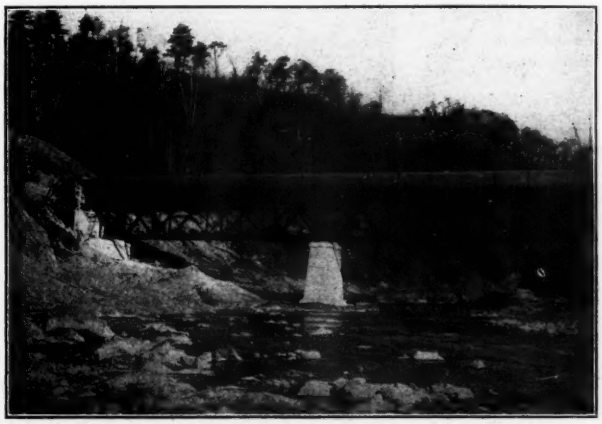


FIG. 10.—MAIN PENSTOCK CROSSING HOOSIC RIVER.

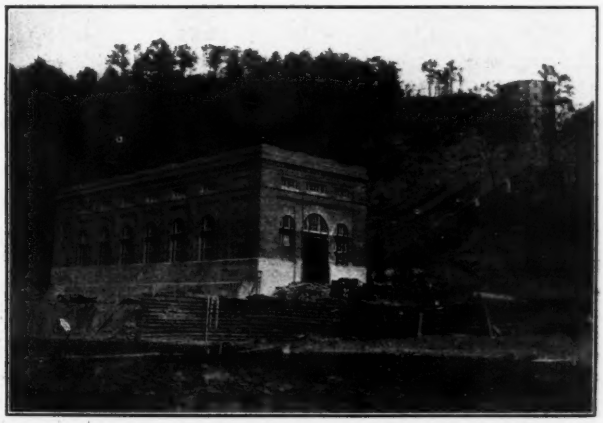


FIG. 12.—SCHAGHTICOKE POWER STATION.

degrees rise in temperature at 3,750 kilovolt-amperes, unity power-factor, and the same temperature rise at 3,300 kilovolt-amperes, 0.9 power-factor, continuous operation.

These guarantees were easily bettered when the machine came to test. The construction adopted in the above units is remarkably strong, compact and simple.

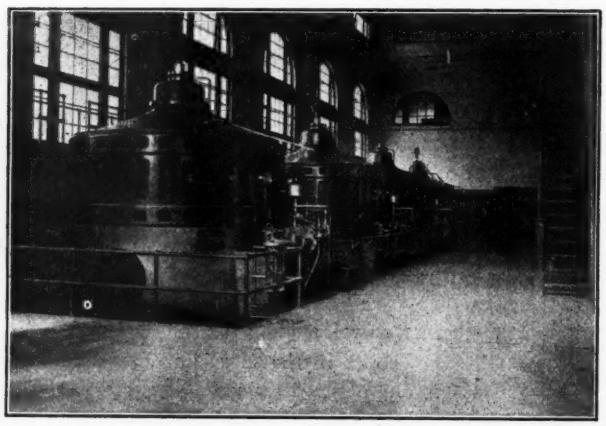


FIG. 13.—INTERIOR OF POWER STATION.

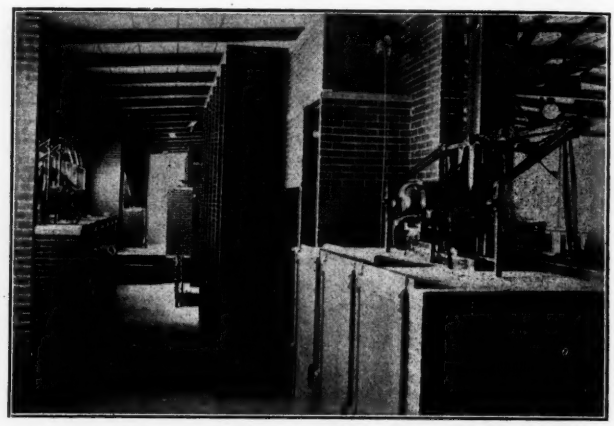


FIG. 15.—HIGH-TENSION OIL SWITCHES AND BUS-BARS.

Exciters.—The exciters are six-pole machines of 150 kilowatts each and run at 600 revolutions per minute and 250 volts. They are provided with shrink-ring commutators and designed to operate with Tirrill regulators. A somewhat unusual feature is the use of the long-extended generator base on which the waterwheel casing is mounted. The guaranteed temperature rise was thirty-five degreees C. in all parts of the machine under continuous operation at full load, and fifty-five degrees C. rise in all parts of machine for a fifty per cent overload applied for two hours. The efficiency guarantees were:

Load.	*Efficiency.*
150 per cent	90.5 per cent
100 per cent	91.5 per cent
75 per cent	90 per cent
50 per cent	89.5 per cent

Transformers.—The transformers are three-phase, water-cooled, forty-cycle, 3,000-kilowatt, stepping up from 4,400 to 32,000 volts. The cooling water is tapped from the exciter penstock inside the power station. At full load the temperature rise does not exceed thirty-five degrees C., and at twenty-five per cent overload, fifty degrees C., the supply of water in the first case being nineteen gallons per minute, and in the second case increased in proportion to the load. The guaranteed efficiencies range from 98.5 per cent at full load to 97.8 per cent at one-half load. The total weight without oil is 43,000 pounds. The transformers are connected delta-delta.

Switchboard.—The generator leads pass through current transformers operating definite time-limit relays to the automatic switches, from which they are led through disconnecting switches to the low-tension 4,400-volt buses, the latter being provided with sectionalizing switches. From the low-tension buses four lines are led through disconnecting switches to the non-automatic oil switches, thence through current transformers to the main power transformers, through the high-tension side of which the leads pass to automatic oil switches operated by series relays of the inverse time-limit type, and from these switches they pass through disconnecting switches to the high-tension 32,000-volt bus. The feeders leave this high-tension bus through automatic oil switches provided with series relays of the inverse time-limit type.

The switchboard, Fig. 18, has eleven panels from left to right as follows: Mill feeder, 4,400 volts; station lighting; high-tension line No. 1; two generator and transformer bank panels; Johnsonville line and field switches; two generator and transformer bank panels; high-tension line No. 2, and two exciter panels. The board is situated on a central gallery, and the operators can overlook the whole station.

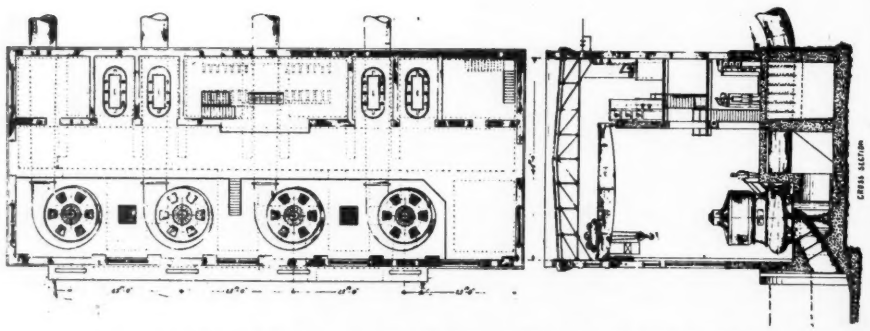


FIG. 14.—PLAN AND ELEVATION OF SCHAGHTICOKE POWER STATION.

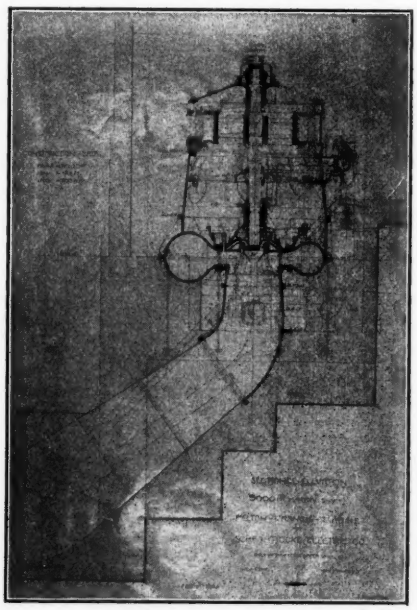


FIG. 16.—SECTIONAL ELEVATION, 5,000 HORSEPOWER VERTICAL-SHAFT PELTON-FRANCIS TURBINE.

The outgoing lines are taken out through bushed housings to the horn

gaps, mounted on a framework, and are connected to General Electric lightning arresters of the electrolytic type. All the electrical apparatus in the power station was supplied by the General Electric Company.

TRANSMISSION LINES.

The power plant was built primarily to supply power to Schenectady, and this transmission line is shown in the map, Fig. 1. Four lines leave the power station, two are carried on double-line towers to Schenectady, one goes to the Johnsonville station, six miles upstream, and the other is a low-tension line for the supply of local mills and factories in the vicinity. The Schenectady and Johnsonville lines are of similar construction throughout and operate at 32,000 volts, while the local line is operated at the generator voltage (4,400 volts).

FIG. 17.—TURBINE CASING.

FIG. 18.—ALTERNATING-CURRENT SWITCHBOARD, SCHAGHTICOKE ELECTRIC COMPANY, HOOSIC FALLS, N. Y.

Towers.—The towers, which were manufactured by Milliken Brothers, of New York, are shown in Figs. 19 and 20. The standard line galvanized steel towers weigh about 4,300 pounds complete. The height of tower over-all from top of foundation is seventy-six feet, and the effective height, that is, from top of foundation to lowest conductor, is forty-eight feet approximately. The average spacing of the towers along the lines is 550 feet.

The straight-line towers are seventeen feet square at the base and are attached to channel-iron anchors six feet deep. Where a deflection of more than ten degrees in the line occurs, special angle towers are employed. These are twenty feet square at the base and anchored in concrete. The concrete anchors are in the shape of a four-sided pyramid, and taper from two feet, six inches square, at one foot above surface, to six feet square at a depth of six feet. For swampy and soft soil these foundations are still further increased. The line is anchored by steel lattice-work stub towers. A three-eighths-inch seven-strand Siemens-Martin steel cable is strung on the top of the towers for lightning protection.

Insulators and Conductors.—The insulators are standard General Electric suspension type, weighing approximately nine pounds per disc, and are rated at 25,000 volts each. Two of these discs are used in series, the arrangement being clearly shown in the photographs of the line.

The conductor used on this line is No. 000 B. & S., seven-strand, copper cable, weighing 0.53 pound per foot length. The 550-foot span has a sag of approximately ten feet, and is designed to withstand a wind velocity of sixty-five miles per hour actually on the cable or forty miles an hour when covered with one-fourth inch of sleet. The right of way

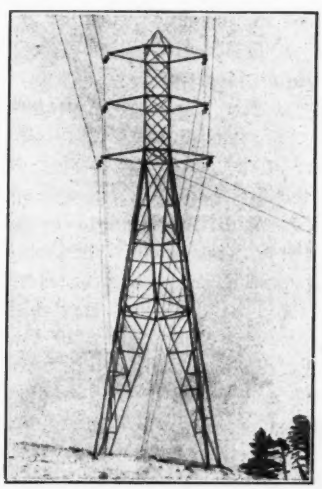


FIG. 19.—STRAIGHT LINE TOWER.

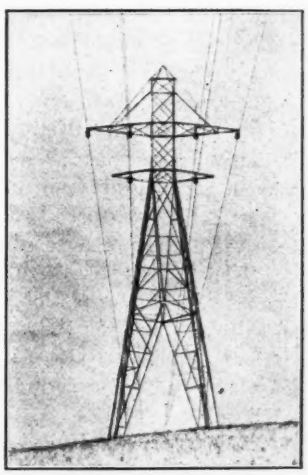


FIG. 20.—TRANSPOSITION TOWER.

is straight across country, with no fencing protection, and the railroad crossings are protected by the drop short-circuiting bar method.

Operating Staff and Personnel.—The operating staff consists of five men working on two twelve-hour shifts, three men on one shift and two on the other, and two men are employed for transmission-line patrol. The consulting engineers of this development are Veile, Blackwell & Buck. Mr. H. W. Starr, of Schenectady, is the vice-president and general manager of the power company, under whose supervision the entire development has been completed.

Metropolitan Street Railway.

Judge Lacombe in the United States Circuit Court granted the application of the Central Trust Company, trustee under the mortgage of the Twenty-eighth and Twenty-ninth Street Crosstown Railroad Company, dated, October 1, 1896, for leave to enjoin the Metropolitan Street Railway Company, as the party defendant in an action pending in the Supreme Court of New York, which is brought for the purpose of foreclosing the mortgage. The request of the Central Trust Company, that Messrs. Joline and Robinson as receivers of the Metropolitan Street Railway Company, also be made party defendants in the foreclosure action was denied.

Judge Lacombe in the United States Circuit Court denied the petition of the Twenty-third Street Railroad Company, to be allowed to intervene in the foreclosure suit of the Morton Trust Company, against the Metropolitan Street Railway Company. A note on the sale of this property is given in another column.

MEETING OF STEEL MILL ENGINEERS AT GENERAL ELECTRIC COMPANY'S WORKS.

SCHENECTADY, N. Y., MARCH 9, 10 AND 11.

At the invitation of the General Electric Company, about fifty prominent steel-mill engineers from all parts of the country met at Schenectady, N. Y., on Tuesday morning, March 9, for the purpose of making a study of the design and construction of the General Electric Company's apparatus. The meeting continued over Wednesday and until the afternoon of Thursday.

As the different engineers arrived at the works they were ushered to a large assembly hall, used for meetings of this kind. Here they registered, and about 10 o'clock the meeting was called to order by Major J. M. Andrews, of the power and mining department.

After a few introductory remarks by Major Andrews and D. B. Rushmore, engineer of the power and mining department, the first paper of the day was presented by W. L. R. Emmett, engineer of the lighting department. The subject of Mr. Emmett's paper was "Steam Turbines," and he dealt not only with the standard form of high-pressure turbines, but also discussed in detail both low-pressure and mixed-pressure units. Mr. Emmett showed by drawings and sketches many interesting points with regard to detail construction and operation of the Curtis type of turbine. At the end of Mr. Emmett's talk, the various engineers were called upon for expressions of opinion, and a very interesting discussion followed.

L. C. Lowenstein, of the engineering department of the General Electric Company's Lynn works, then took the floor and discussed centrifugal compressors, particularly as applied to steel mills. Many lantern slides and sketches were used to illustrate this topic. The engineers then adjourned to the works' restaurant for luncheon.

The afternoon was taken up by the inspection of the turbine shops and power station. In the turbine shops they were shown machines in every stage of manufacture, and the new power station, which includes about 10,000 kilowatts in turbo-generators, was shown in full operation. A feature of special interest in connection with the inspection of this power station was the starting up of a 5,000-kilowatt unit, which had not been run during the day, but which was being held as a spare. This unit was started up with no preliminary warming, and the generator was phased in in exactly one minute and ten seconds from the opening of the throttle. This particular unit is a forty-cycle, 800-revolutions-per-minute machine, and has a maximum continuous capacity of 7,500 kilowatts, although nominally rated at 5,000 kilowatts.

Later in the afternoon, the switchboard department was inspected and several large boards were shown in the course of assembly. Large oil switches and air-break switches were shown and operated.

As hotel accommodations had been reserved at the Ten Eyck in Albany, a special car over the Schenectady Railway Company's lines took the party direct to Albany, where dinner was served in a private dining room. The evening was spent at the theatre.

On Wednesday, the special car left Albany at about 8 o'clock, and upon its

MEETING OF ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS, SCHENECTADY, N. Y., MARCH, 9-11, 1909.

arrival at the works the meeting was called in the assembly room. This session was opened by a paper presented by K. A. Pauly, one of the engineers of the power and mining department, who has, for the past few years, been closely associated with steel-mill work. The subject of Mr. Pauly's paper was "Mill-type Motors." The question of direct current vs. alternating current for operation of complete plants was gone into very thoroughly and was discussed at length by the engineers themselves. It was shown that complete alternating-current mill equipments could be installed at a cost of about twenty per cent to twenty-five per cent lower than could the direct-current equipments, this statement applying particularly to large new installations. Mr. Pauly also described and illustrated with lantern slides the 6,000 and 2,000-horsepower motors which were built and installed by the General Electric Company at the new Gary steel plant.

Following Mr. Pauly's paper, H. E. White, of the controller engineering department, talked on the design and operation of automatic control equipments. Many lantern slides were shown, illustrating the various developments along this line. The engineers also discussed the control equipments.

Luncheon followed at the works' restaurant, and the afternoon was taken up by practical demonstration of what was described in the morning. Mill-type motors, both alternating current and direct current, were shown, operating under all conditions. Various types of control equipments were wired up to the motors, and the engineers were given every opportunity to operate these themselves. The machines were also opened up, so that the construction of every part might be seen, and were afterward assembled to show the ease of replacing parts.

An interesting feature in connection with these tests was the starting and reversing of the motors, particularly the direct-current machines, by double-throw switches, throwing them directly on the line with no resistance in series. A fifty-horsepower direct-current motor, operating under full load in one direction of rotation, was thrown directly on the line in the reverse direction. This was done several times at various loads and speeds, and in several cases the speeds were from fifty to sixty per cent above normal at the instant before reversing. The full-load current of this motor is 190 amperes, and at the instant of reversing, peak loads as high as 1,200 to 1,500 amperes were obtained. This test was generally admitted to be a remarkable one, and, as one of the engineers jokingly said, "We need no more control equipments—give us a double-throw switch."

After the inspection of the motors and control equipments in operation, the controller shops were shown, and here the various types of control, both automatic and hand operated, were exhibited, including an equipment for a 6,000-horsepower motor.

During the evening, dinner was served at the Mohawk Club in Schenectady, and toasts were responded to by several of the visiting engineers and also by the officials of the General Electric Company.

Dr. Steinmetz opened the meeting on the morning of March 11 by outlining the various systems of distribution of power. He also covered briefly, but in a comprehensive manner, the lightning-protection problem, as solved by the aluminum-cell arrester.

Prof. E. E. F. Creighton followed Dr. Steinmetz, continuing the presentation of the lightning-protection situation. His talk was illustrated by a number of effective experiments with high-frequency electrostatic discharges, showing the method of protection from these discharges by means of the aluminum-cell arresters. During the morning the party inspected a typical installation of commercial aluminum arresters on one of the company's high-voltage transmission lines.

Pittsburg Section, American Institute of Electrical Engineers.

The regular monthly meeting of the Pittsburg Section of the American Institute of Electrical Engineers was held in the Carnegie Institute, March 9, W. E. Reed, chairman, presiding.

The subject for discussion was "Single-phase Railways," and a large attendance greeted the speakers of the evening. The papers were limited to ten minutes in length, a lantern being provided to assist in the presentation of the subjects under discussion. The papers presented were: "The Single-Phase Railway System," Clarence Renshaw; "The Single-Phase Motor," S. M. Kintner; "Catenary Line Construction," T. Varney; "A Comparison Between Single-Phase and 1,200-Volt Direct-Current Systems," F. E. Wynne; "The Single-Phase Systems in Operation," G. D. Nicoll, electrical engineer of the Pittsburg & Butler Street Railway Company; "The 1,200-Volt Direct-Current System in Operation," Harry Etheridge, chief engineer of the Pittsburg, Harmony, Butler & Newcastle Street Railway Company.

There was unusual interest shown in the discussion of this subject. N. W. Storer opened the discussion, and was followed by James Bryan, consulting engineer, and one of the chief advocates of the 1,200-volt direct-current system. Mr. Bryan's discussion of the subject was in a humorous vein, and the good-natured banter between the advocates of the various systems kept up a lively interest among those present, and afforded considerable amusement.

The other speakers were W. L. Waters and B. A. Behrend, of the Westinghouse Electric and Manufacturing Company, and W. E. Moore, of the West Penn Railways Company.

The next meeting will be held April 6, and will take up the subject of live-line repairs and maintenance, with a view to preventing interruptions of service. The principal paper will be presented by J. S. Jenks, chief engineer of the West Penn Railways Company.

An Association of Central Stations and Electric Vehicle Companies.

At a dinner given in Boston, Mass., March 11, a new organization was formed for the purpose of uniting manufacturers of electric vehicles and the managers of central lighting and power stations.

The purpose of this new organization is to promote the use of electric vehicles for business and pleasure, and to stimulate both the vehicle manufacturer and the central-station manager to renewed effort to increase the popularity of these vehicles. It is a matter equally advantageous to the manufacturer and the central-station man, in that the revenue derived from the sale of current will aid in straightening out the load line on the power station, and the facilities extended by the central station for the recharging of batteries will popularize the use of these vehicles.

The meeting was well attended and addresses were made by W. H. Atkins, Boston, representing the Boston Edison Company; Wm. P. Kennedy, chief engineer of the Studebaker company, and Frank J. Stone, Boston, representing the Electric Storage Battery Company, and others.

The officers of the association are: President, Frank J. Stone; secretary, H. F. Sands; treasurer, L. R. Wallis. Executive committee, Day Baker, Col. E. W. M. Bailey, S. G. Thompson, A. C. Gray, A. F. Neale, J. H. Neal, E. C. Manson, C. B. Davis and N. T. Wilcox.

ALTERNATING CURRENTS AND THEIR APPLICATIONS.

BY EDSON R. WOLCOTT.

CHAPTER VI. (PART III.)—LIGHTING.

VAPOR LAMPS.

The discharge of electricity through gases has long been recognized as offering a possible solution to the troublesome problem of obtaining highly efficient electric lighting, but the practical difficulties in applying the principles are not easy to overcome.

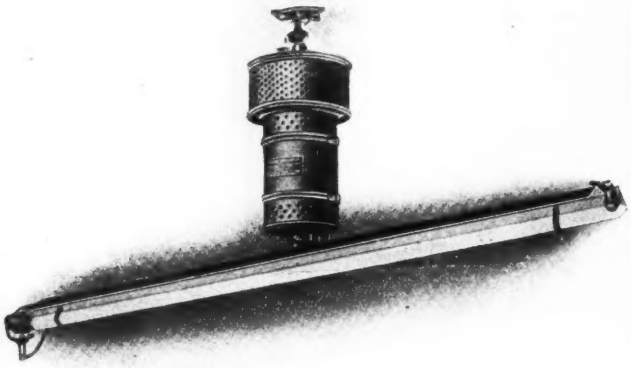


FIG. 136.—COOPER HEWITT MERCURY-VAPOR LAMP.

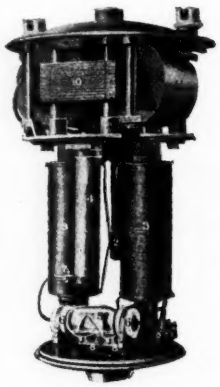


FIG. 137.—AUXILIARY FOR COOPER HEWITT LAMP.

In general, a gas is a better conductor of electricity when under less than atmospheric pressure, and the light phenomena of the partially exhausted tubes of Geissler, Crookes and others have been studied in great detail. The manner in which the rarefied gases conduct the electric current is more like that of an electrolyte than a metal. Under suitable conditions the gas assumes a conducting state which is called ionization. The electric discharge itself is an ionizing agent in that it is more difficult to start the discharge than it is to maintain it.

The kind of gas or vapor left in the partially exhausted tube affects the color of the glow, as does also the kind of glass used and the material of which the electrodes are constructed.

MERCURY-VAPOR LAMP.

The mercury-vapor lamp is an example of this type. As shown in Fig. 136, it consists of a long tube made of glass or quartz, containing a small quantity of mercury. After the mercury is inserted the tube is exhausted and sealed. The lower enlarged end of the tube carrying the mercury acts as the cathode through an external connection. The positive electrode is double and consists of two iron cups at the other end of the tube. The current is conducted to the electrodes by means of platinum wires sealed into the glass.

The efficiency of this type of illuminant is very high; it would be in more general use were it not for the fact that the light given off by the incandescent mercury vapor is of a decided greenish tinge. In fact, it is almost entirely lacking in the red rays, and the result is that all red objects look black or purple when exposed to this light, while all colors containing red are falsely rendered. It is claimed that the light is not fatiguing to the eyes, and where color distinctions are not essential, as in drafting rooms and factories, these lamps are in very successful operation. They are also rich in actinic rays and are desirable for use in photography and blue-printing.

A voltage higher than that needed for operating is necessary in starting vapor lamps; that is, some of the mercury must be vaporized. One method of doing this has already been described in the section devoted to mercury-vapor rectifiers of alternating current. As originally used, these lamps operated only on direct-current systems, but by a combination of a converter and a direct-current lamp, an alternating-current mercury-vapor lamp is available. This is done by the use of an auxiliary containing an auto-transformer, as illustrated in Fig. 137, which supplies the proper voltage to the tube at the two positive electrodes and the negative electrode which is connected to the middle point of the transformer. The reference figures in this illustration are as follows: 1, binding posts for supply; 2, adjuster; 3, inductance coils; 4, shifter resistance; 5, shifter; 6, shifter bearings; 7, binding posts for shifter leads; 8, binding posts for leads to tube; 9, terminal block; 10, auto-transformer. The device shown in Fig. 137 is intended for automatically starting the lamp on closing the circuit switch. This is done by the shifter, which, on turning, interrupts the current through the mercury bridge. This causes the inductance to momentarily impress a voltage between the negative and positive electrodes and between the mercury and the starting-band that is sufficiently high to start the lamp.

A simplified diagram of the starting and operating circuits of the lamp is shown in Fig. 138. In this case, however, the lamp is started by tilting the tube by hand. In this diagram A is the auto-transformer, R′ the starting resistance, R the lamp resistance, and I an inductance to cause enough lag in the current to carry it over zero points in the wave. During one alternation current is supplied by one-half of the transformer through the lamp tube and back to the neutral point, and during the next alternation the other half of the transformer supplies the current. In starting this lamp, the mercury on tilting the tube comes in contact with a pin placed in the head of the lamp and connected with one of the positive electrodes through a high resistance R′. On breaking the continuous mercury stream through the tube the arc is started and readily transferred to the positive electrodes alternately.

THE MOORE VACUUM-TUBE LIGHT.

The phenomena observed in the tubes of Geissler have been applied by Moore as a means of artificial illumination. When a tube containing air or other gases is exhausted to a pressure of a fraction of a millimetre of mercury a high-potential discharge fills the tube with a soft, quiet glow. The small amount of gas remaining in the tube acts as the carrier of electricity and is a very efficient source of light.

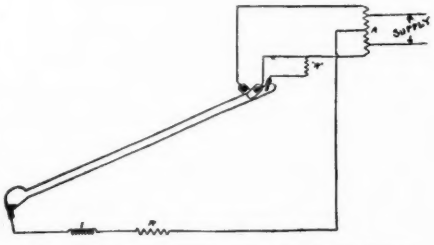


FIG. 138.—CIRCUITS OF ALTERNATING-CURRENT MERCURY-VAPOR LAMP.

The Moore vacuum-tube light has been in commercial use since 1903. Although an efficient means of illumination, this

system offers considerable difficulties in installations.

As shown in Fig. 139, a step-up transformer (4) connected to the ends of the tube and the feeder valve (7) are enclosed in a box (2) which can be located in a safe convenient place. The projecting glass tube is about one-and-three-fourths inches in diameter, and may be of any desired shape or length up to 200 feet, as illustrated in Fig. 140. A graphite electrode (3) is sealed into each end of the tube and connected one to either terminal of the secondary of the transformer. The feeder valve supplies the tube with pure gas to take the place of that used up in the passage of the electric discharge.

The electric discharge increases the vacuum of the tube, so that the conductivity is decreased, since the maximum conductivity is attained under a pressure of about one-tenth millimetre of mercury.

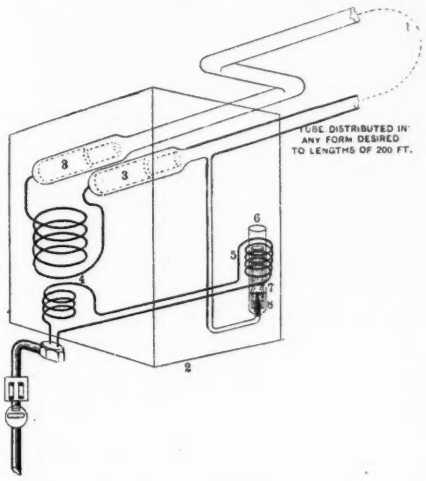


FIG. 139.—CIRCUITS OF TERMINAL BOX OF MOORE TUBE.

The feeder valve is adjusted to maintain the gas pressure at the point of maximum efficiency, which is slightly above the pressure giving maximum conductivity. A carbon plug is cemented into the small tube leading to the main lighting tube. This plug is normally covered with mercury, the level of which is varied by means of a glass displacer connected to the plunger of the solenoid which surrounds the upper part of the tube and which is connected in series with the transformer. As the pressure in the lighting tube falls from the value of maximum light efficiency, the conductivity, and therefore the current, is greater; the plunger is thus slightly raised, the level of the mercury is lowered and the carbon plug exposed. A small amount of gas filters through into the lighting tube and the pressure increases to its original value. This valve is capable of very close adjustment.

The efficiency is said to be about 1.5 to two watts per candlepower. The voltage of the secondary of the transformer depends on the length of tube. When

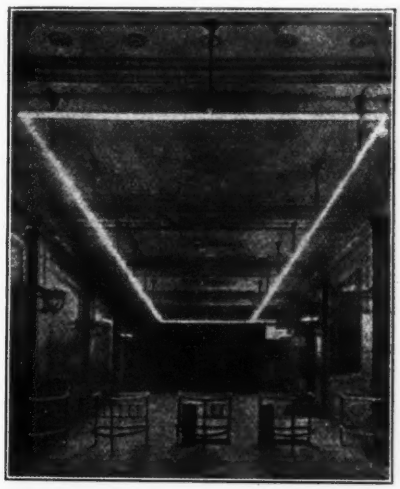


FIG. 140.—MOORE TUBE LIGHTING IN THEATRE LOBBY.

the feeder valve is supplied with pure nitrogen the light is about the same as white diffused daylight; when supplied with air, the color is orange-pink. The long glass tubes are built up on the premises of short lengths hermetically sealed together by a special process. A compact form of Moore tube is shown in Fig. 141.

Single-Phase Railways of Europe.

In last week's issue, on page 534, was given a table compiled by the Siemens Brothers' Dynamo Works of England,

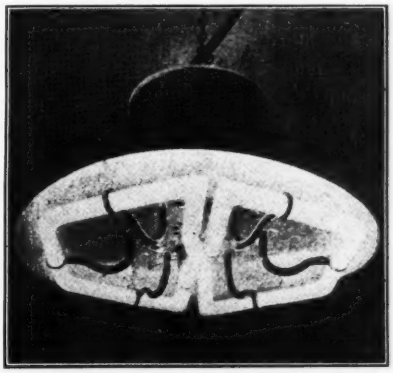


FIG. 141.—COMPACT MOORE TUBE UNIT.

giving the European single-phase railways equipped with Siemens apparatus. The total length of these lines is 367.25 miles. Unfortunately the article conveyed the impression that these are the only single-phase lines in Europe, which is manifestly not the case.

Lectures on Electric Vehicles, Storage Batteries and Central Stations.

A lecture will be given on Monday, March 29, at 8 p. m., in the Electricity Building, Case School of Applied Science, Cleveland, Ohio, and also on Wednesday, March 31, at 8 p. m., in the rooms of the Western Society of Engineers, Monadnock Building, Chicago, by Bruce Ford of the Electric Storage Battery Company, Philadelphia.

The subject of the lecture will be the "Exide Battery in Vehicle and Sparking Service," and will be illustrated with a series of lantern slides. A general discussion of the subject will follow, in which all present are invited to take part.

At the Chicago lecture an address will also be made by E. W. Lloyd, contract agent of the Commonwealth Edison Company, on "The Relations of Central Stations to the Automobile Business." Mr. Van Splunter, of the General Electric Company, will also make an address on "Rectifiers."

Cards of invitation have been forwarded to all who are interested, and if any have failed to receive these they can secure them at any time before the Cleveland lecture at the offices of the Electric Storage Battery Company, Citizens' Building, Cleveland, and before the Chicago lecture at its Chicago offices, Marquette Building.

Morse Electric Club Dinner.

The second annual dinner of the Morse Electric Club was held at the Hotel Savoy, New York city, Saturday evening, February 27. Over 200 telegraph and railway men were present, the president of the club, John B. Van Every, acting as toastmaster. Addresses were made by William C. Brown, president of the New York Central Lines; Colonel Robert C. Clowry, president and general manager of the Western Union Telegraph Company; William J. Dealy, Henry D. Estabrook, Judge Morgan J. O'Brien and E. T. Jeffery, president of the Denver & Rio Grande Railroad Company.

Subways for Pittsburg.

Notice has been published in Pittsburg, Pa., that application will be made on April 1 for charters for two companies which propose to construct subways for rapid transit beneath the business district of Pittsburg. Both companies are to have the same incorporators, the chief promoters being officials of the Pittsburg Brewing Company. The two are to be supplementary, covering city and suburban traffic.

SECOND ANNUAL CONVENTION OF THE MINNESOTA ELECTRICAL ASSOCIATION.

MINNEAPOLIS, MINN., MARCH 18 AND 19.

The second annual convention of the Minnesota Electrical Association opened in the Nicollet Hotel, Minneapolis, on Thursday morning, March 18. Owing to the resignation of President W. R. Putnam, consequent upon his removal from the state, R. E. Brown, of Mankato, chairman of the executive committee, presided. The reports of committees showed the association to be on an excellent financial basis, with a considerable increase in membership from the 170 central stations in the state. Preliminary steps were taken toward the establishment of a committee on publicity.

The first paper was by the secretary, Ludwig Kemper, of Albert Lea, on "Buying Coal on a B. T. U. Basis." Steam generation resolves into two distinct parts: The purchase of a coal of suitable grade which will give the greatest number of British thermal units in front of the boilers for one cent; and the burning of this fuel so as to realize the greatest proportion of the heat units. For the latter, the requirements are: Feed the fuel as uniformly and continuously as possible; supply air only slightly in excess of the theoretical amount; maintain sufficiently high temperature in the furnace to ignite the gases; completely consume the gases before they strike cooling surfaces; keep boiler settings tight and heating surfaces clean. The choice of coal involves a study of the grades which can be burned in the furnaces without reducing the steaming capacity of the equipment. Coal of such grades should be chosen on a basis of the heat units per ton, making proper allowance for ashes and moisture. Tests of sample carloads are not as reliable as continuous testing of samples from every car bought under the contract. As the quality varies from car to car and from month to month, being generally poorer in the winter months, the contract should specify a proportionate premium or rebate for variations from the standard. The coal testing should be done by a disinterested party. Regular testing practically insures a better grade of coal than that bought in the open market, and an improved efficiency of one or two per cent at the furnace means an improved efficiency through the entire equipment, which more than pays the cost of the testing. For efficient burning of the fuel, the waste gases should be tested for carbon dioxide, which should not be too low, and for temperature, which should not be too high. Discussion of the paper elicited the statements that at first the coal dealers objected to bidding on the heat-unit basis, but now such bids are obtainable. The guaranty contract should provide for purchase of fuel from other sources in case the regular supply is cut off for any reason. As a result of buying coal on a heat-unit basis, and of accompanying greater care in the fire room, a marked reduction in the cost of generating a kilowatt-hour has been effected.

The second paper was by T. L. Daniel, of the Minneapolis Steel and Machinery Company, on "Prime Movers for Small Central Stations." Many complex questions arise in connection with the choice of prime movers. The use of stokers and low-grade fuels and lignites increase; an evaporation of 10.18 pounds of water from and at 212 degrees is reported for Wilton slack lignite. The advent of the gas engine has been a great impetus to development and investigation of many problems connected therewith. The steam turbine has brought up many problems which are being solved in various ways. The cost of developing power divides into fixed and operating charges, whose proportions vary greatly with the type of prime mover and with local conditions. For units up to 500 kilowatts, the Corliss engine is the standard for comparing economy, reliability and durability, the two latter being favored by low speed. For sizes up to 500 kilowatts, Corliss engines run regularly up to 125 revolutions per minute, and occasionally up to 200 revolutions per minute, with piston speed as high as 1,200 feet per minute. The high-speed engine is continually improving, and is suitable where fuel is cheap or where it is a question between something cheap or nothing at all. Between the best grade of high-speed and of Corliss engine, there is not much difference of cost. High-priced fuel, restricted water supply, heavy service and big overloads favor Corliss types. The producer-gas plant is adapted to plants where fuel is high or of poor quality and where water is bad or scarce; its economy of fuel, ease of firing, safety from serious accidents, from careless operation, simplicity and smokeless combustion offset its high first cost and large floor space. The steam turbine has a field where space is valuable and foundations are troublesome; its simplicity, absence of reciprocating parts, fewness of pins and bearings and consequent ease of operation are recognized, as are also the uncertainty of repairs and of depreciation, possibility of serious damage in case of some slight neglect, difficulty of securing experienced operators and the fine conditions of operation. For the sizes here considered, a non-condensing turbine plant without superheater would cost less than the Corliss plant, its economy would about equal that of a high-speed engine, and its depreciation by erosion and its liability to serious accident would be serious. The combination of reciprocating engine and steam turbine should be considered only in connection with an existing plant, and then only when the plant evidently had many years of useful life ahead. In comparing manufacturers' guarantees of efficiency, care should be taken to know the probable performance after a period of years, and which cannot be guaranteed by the makers as being dependent on local conditions beyond their control. The fixed charges should be based on the cost of the entire plant, including real estate, buildings and foundations. The total costs should be considered in connection with special items which can hardly be covered by figures, but which may turn the scale in favor of one or the other type of prime mover. Regulation is important; some engines which give regulation within one per cent when new, have double the range after some wear, and soon regulate less closely than others which only claim two per cent, and which get better as the valves wear to better seats. The discussion mentioned desirable practice for new plants whose loads were small compared with what was to be expected later; the boiler pressure might be kept low during light loads; sometimes the low-pressure cylinder is disconnected, or only the high-pressure side of a compound Corliss engine is installed at first; sometimes the cylinders are bushed when running regularly at small loads; belted Corliss engines are sometimes run at slow speed, using a small pulley on the generator, speed and pulley being changed when the load grows. Combination of steam and producer-gas plants is sometimes desirable when it is expected to displace the steam equipment as it wears out.

The only paper read at the afternoon session was by Prof. George D. Shepardson, of the University of Minnesota, on "Meters." After the reading and discussion of this paper, the association went in a body to visit the engineering laboratories at the University of Minnesota.

A complimentary dinner was enjoyed at 6:30, followed by a theatre party, both being tendered by the Twin City manufacturers, jobbers, supply houses and manufacturers' representatives.

METERS.

The paper on "Meters," by Prof. George D. Shepardson, of the University of Minnesota, discussed the various types of instruments called meters, such as watt-meters, ampere-hour meters and kilowatt-hour meters, which have been developed from various electrical phenomena, such as electrostatic, chemical, heating, electrodynamic and electromagnetic effects. Electrostatic effects have been used for wattmeters but not for watt-hour meters. Chemical effects are adaptable for ampere-hour meters, such as formerly used by the Edison companies and such as now made by the Helios Electric Company. Heating effects are used somewhat in indicating instruments, such as voltmeters and ammeters, but have not been developed into successful integrating instruments; the heating effect is successfully used in apparatus for indicating the maximum current used, the Wright demand meter being in service in connection with watt-hour meters with multiple-rate systems of charging. Electrodynamic attraction and repulsion between neighboring wires and electromagnetic effects between wires and magnetic fields constitute the basis of most indicating instruments and also of most integrating instruments.

The integrating instrument is an elementary motor provided with a drag which is proportional to the speed of the motors. Meters of the commutator type are suitable for direct or alternating-current measurement and measure correctly almost independently of the power-factor of the load. The range of an electrodynamometer meter may be increased by the use of resistance in series with the pressure circuit or by transformers in the pressure or main circuit. Polyphase power may be measured by two wattmeters properly connected. Induction meters are generally preferable for alternating-current systems, being lighter and being less affected by external influences. Friction may be compensated by special coils, but care must be taken to avoid creeping on no-load; vibration tends to increase the speed, especially on light loads. The friction increases with wear, and both the pivot and the jewel should be renewed after about 1,000,000 revolutions. The manufacturers have adopted a liberal policy in sending printed matter upon request. The paper closed by quoting the report of a committee on meters to the New York Public Service Commission. In the discussion several curves were shown to illustrate the effects of vibration, friction, frequency, voltage, wear and power-factor. The effects of stray magnetic fields, neighboring masses of iron and damage by lightning were discussed.

DAY LOADS.

The papers and discussions on Friday morning were devoted to the building up of day loads. Adolph Wagner of New Ulm discussed "Methods of Building up a Day Load in the Small Central Stations." Such service must be built up before it pays, but the cost is less than that for the night service, since little if any additional equipment need be bought. The fixed charges are the same whether the plant operates eight, twelve or twenty-four hours, and the only additional expense is for fuel, labor, supplies and repairs, with some depreciation. Securing a paying day load is a matter of education. Advertise well that the day service is available, and make it reliable. A card index of possible customers should be made, keeping a record of all prospects, success or reasons for failure to secure, noting whether each uses laundry irons, etc. At intervals repeat efforts to secure new customers and to induce others to use current-consuming apparatus. Wiring should be done at cost, since the station should make its money from current rather than from supplies; large cost of wiring may drive away possible customers; but a customer once connected and furnished with electrical conveniences will remain a customer always. The wiring should be done right and provision should be made for adding to the first installation without changes in the wiring.

Keep a stock of apparatus that is likely to be called for; motors for use of emergency customers frequently gain permanent business. Show confidence in current-consuming devices by offering to put them out on trial. In estimating cost of power to prospective motor customers, make liberal allowances for the load factor, which is considerably lower than most power users suppose. Pumping of the town water supply is generally very expensive and can be done economically and profitably by the central station with electric motors at off-peak hours. Laundry irons, washing-machine motors, fan motors, heating pads, vibrators, etc., bring in revenue, small individually but considerable in the aggregate. Many lights will be used all day in otherwise dark places. A showroom should be maintained either permanently or once a year in some busy part of the town. Special rates may be made for day power, but minimum monthly bills should be established. Of the 112 stations in towns in Minnesota having between 1,000 and 10,000 inhabitants, thirty-seven have a day service and seventeen others expect to start a day service soon. In addition to the thirty-seven stations now furnishing day service, three others have a so-called ironing day, that is, they operate their plant one-half day each week to allow their customers to do their ironing with electric irons.

In a paper on "Heating Appliances as an Aid in Developing a Day Load," E. L. Callahan of Chicago recommended the placing of residences on separate feeders from the commercial district, in order to facilitate the determination of the increased average load due to the installation of heating apparatus and small motors.

In a paper on "Small Motors and Their Possibilities in Developing a Day Load," George J. Cadwell called attention to the difficulties met by the early central station in establishing day loads because of the unsatisfactory state of development of the motor. While the modern heating and cooking utensils have opened new possibilities for the central station, the small motor opens still greater fields, and a consideration of the various activities of life in the average town shows that the motor may be used to advantage in a great many ways. The desirability of the motor for elevators and dumb-waiters is recognized by all; in the hotel kitchen motors may be used for peeling potatoes, chopping meat, washing dishes, grinding knives, buffing silver, making ice cream and mixing dough for baking. The hotel laundry cannot afford to be without motor-driven washing machines; an electrically-driven vacuum-cleaning outfit and carpet-sweeper will make a considerable saving to the hotel man, besides sweeping the hotel cleaner than it ever could be using old-fashioned methods, and increasing the revenue of the central station. In hotels, as well as in restaurants and saloons, motor-driven refrigerating plants are likely to reduce the cost of refrigerating considerably, and the ventilation of such places cannot possibly be handled any better than by electric exhaust fans.

In the dry-goods business the electric

motor is applicable to moving window displays, elevators, dumb-waiters and cash carriers; the drug store uses motors for ice cream freezer and carbonating machine, and the grocery for the coffee grinder and, if run in connection with a meat market, with meat choppers, sausage machines and possibly refrigerating machinery. In like manner motors are useful in offices, especially for ventilating, cleaning and for elevators, while electrically-driven pumps are not infrequent. Likewise, the baker, the confectioner, the banker, the cobbler, the barber, the jeweler, the printer, the blacksmith and the liveryman find small electric motors very economical. The vacuum-cleaning business might well be pushed harder by the central-station interests. In a private residence much work may be done better by motors than by manual labor, such as dishwashing, sewing, laundry work, ventilation, pumping, vacuum-cleaning, etc. In many cases there are possibilities of developing profitable business in supplying current for light and power to the farm communities adjoining the town. The alternating-current motor has been developed so that it may now be guaranteed for satisfactory operation on any kind of circuit, provided the frequency remains constant.

The discussion of the papers on day loads brought out the fact that a few direct-current central stations of moderate size use storage batteries for carrying the load during part of the day. A prime source of difficulty which has been experienced in the operation of single-phase motors on high-frequency circuits is that while the frequency is nominally 133 cycles, the frequency actually found is anything between 109 and 165. Large motors should be fed by separate feeders to which no lights should be attached. Others recommend the use of liberal feeders, so that the same transformers are available for both day and night service. Portable wood-sawing outfits make profitable business when within reach of the supply circuits. Large building operations make considerable use of motors for mixing concrete, hoisting purposes, etc. Motor-driven fans for heating and ventilating buildings, especially public buildings, bring profits. "Everything that turns" in at least one town in Minnesota is driven by electric power, a comparatively small town having about 900 horsepower in small motors. Nine out of ten flatirons will stay if placed on trial. People who refuse to take flatirons on trial are frequently convinced by their neighbors. An incidental advantage of the use of flatirons and other domestic appliances is the greater ease of satisfying a customer who thinks that his bill is too large, but who has overlooked the fact that his family has had the advantages offered by the miscellaneous electrical comforts.

The miscellaneous uses of electricity come principally at times of small load. Effort should be made to build up the load between midnight and morning. The station manager may well afford to spend money in popularizing the business. The adoption of electric light often follows the installation of a motor. Window lighting paves the way for lighting the rest of the store. A small motor which operates satisfactorily induces the customer or his friends to put in other motors. Of three thousand flatirons put out on thirty days' trial in Minneapolis, less than three per cent were returned; many houses have several, there being seven found in one residence. Practically all industrial uses of electricity in the home miss the peak lighting load and so do not increase the necessary investment either in the station or on the lines. In a comparatively small village the January income was increased from $800 to $900 during the past year, in spite of the introduction of tungsten lamps. By announcing that a day circuit was to be established so that current would be always on tap, one manager was able to secure a number of new customers for lighting. Many customers were secured by having a demonstration shop at the station where prospective customers could be shown in advance just what it would cost to operate each lamp or other device, and where estimates of cost could be checked by actual meter reading. The fireless electric cooker is likely to become a very popular current-consuming device, demonstrations showing that it will bake bread by electricity at a cost of about one-half cent per loaf, which is one-half the cost of gas and one-fourth the cost of coal; this will enable the stations to enter a field not heretofore opened, and that, too, at the regular lighting rates.

TUNGSTEN LAMPS.

The closing session on Friday afternoon was given to the reading and discussion of papers on tungsten lamps. J. R. Cravath of Chicago discussed "The Use of Tungsten Lamps from the Illuminating Engineering Standpoint." Tungsten lamps require special treatment because of their greater size of bulb, higher candlepower and higher intrinsic brilliancy of filament. Practical efficiency requires shading the direct light from the filament and also changing the distribution by reflecting the light to places desired. Direct light not only reduces the sensitiveness of the retina (as though the nerves concentrate their attention on the strongest light source in the range of vision), but also induces the automatic closing of the iris. The horizontal light leaving a light-source is of comparatively little value, since it strikes the side walls and is reflected several times before it reaches the working surface; consequently the reflector should throw the horizontal light downward. Deep reflectors are used either to direct the light upon the work or to send it to the ceiling, whence it is again reflected. Deep reflectors, if scientifically designed, reflect from fifty-five to seventy-five per cent of the light downward at angles below seventy-five degrees from the vertical, and also shade the eye from the direct rays if the tip of the lamp is frosted. Four types of translucent reflectors are now on the market. Horizontal rays of light give a blinding effect; shallow or flat shades are worse than none, since they both darken the ceiling and allow an excessive amount of light to strike the side walls. Some customers demand glare. The cost of proper shades is comparatively small. Tungsten lamps should be hung high and should have deep shades.

For indirect lighting the ceiling should be of a light color and the reflectors should be deep; the total efficiency is lower than with direct lighting. The absorption at the ceiling is from thirty-three per cent upward. Lamps and reflectors should be cleaned frequently, since the tops of both are hidden and likely to go unnoticed. Opaque reflectors are used for indirect lighting, mirror coatings being more efficient than enamel or polished metal. Direct and indirect lighting are frequently combined to advantage. There is generally sufficient variation in intensity to avoid the flatness and lack of perspective experienced when shadows are completely eliminated.

H. J. Gille of Minneapolis discussed "The Use of Tungsten Lamps for Decorative Street Lighting." The prosperity of a town is shown by the decorative and illuminating effect in the streets, and the visitor is apt to get his first and strongest impressions from the evening appearance of the streets and show windows.

Conspicuous windows attract passers-by and the cheerful appearance of a store well lighted draws in trade. Similarly, a well-lighted street extends a welcome to visitors to the city. The street-lighting fixtures should have an artistic appearance day and night—not too spectacular but dignified. For special lighting, such as that on Nicollet Avenue in Minneapolis, the property owners paid for the installation and the tenants maintain the lighting. The modern business life continues twenty-four hours daily, and the principal streets should be always light. Arcs for general street lighting are obsolescent, a result made possible by the tungsten lamp. Street illumination by arc lamps has been recognized as unsatisfactory. The advent of the tungsten lamp has made possible the artistic and sufficient illumination of both commercial and residence streets at a cost within reach. The artistic posts used in Minneapolis, with four lamps on side-arms and one on top, cost $85 per post delivered and $60 for installing complete, making a total cost of $145. The cost of current, renewals, cleaning, painting, switching, etc., is $78 per post per year, four side lamps burning until midnight and the top lamp burning from dusk until dawn. Excessive lamp breakage was expected at street corners, but has been found moderate. The first 383 lamps renewed had an average life of 561 hours, the second lot having more than twice the life of the first lot; adding those still in service indicates an average life close to 800 hours. A new post with two side-arms having two 100-watt lamps in twelve-inch globes is being developed at a cost of about $30 per post. Nicollet Avenue is believed to be the most satisfactorily lighted street in the world at the present time. Merchants on neighboring streets feel that they are out-of-town, and the artistic lighting is extending to other streets through the efforts of local organizations.

Tungsten lamps are less sensitive to changes of voltage than carbon lamps, but they should not be overstrained; it is better to run them under rather than over normal voltage; their light is so white that they give satisfactory light several volts below normal; if the voltage varies more than two per cent, better life is obtained by ordering lamps for the higher range, say 114-volt lamps for circuits of nominal 110 volts. With fluctuating voltage the abuse per dollar of investment is greater with tungsten than with carbon lamps. For commercial lighting the renewal of lamps should be at customer's expense; no argument remains for free renewals, since all the tungstens are first class, and the station does not need to protect itself against poor lamps; there is no more reason why electric lights should be renewed free than there is why gas companies should furnish free mantle renewals.

The discussion, partly included in preceding paragraphs, noted that the 220-volt plants are debarred from using tungsten lamps, except by connecting two in series, which requires that they be sorted specially. The desirability of installing a balancing set and neutral wire was urged, so that 220-volt systems could be changed to 110-110-volt three-wire systems; this would enable the substitution of 1.25-watt tungsten lamps for the four-watt 220-volt untreated carbon lamps generally used; the expense of such change should be shared with the customers, as could probably be done by advance agreement.

ELECTION OF OFFICERS.

Officers for the ensuing year were elected as follows: President, H. J. Gille, Minneapolis; vice-president, T. Pitts, Hutchinson; second vice-president, G. Marvin, St. Cloud; secretary-treasurer, B. W. Copperthwait, Faribault; members executive committee, H. A. Hildebrant of St. Peter, B. F. Strong of Chaska, and E. W. Errick of South St. Paul.

Suitable resolutions of thanks were extended to various persons, and the executive committee was directed to investigate the desirability and feasibility of effective work by a committee on publicity. The technical committee was instructed to investigate gas-producer plants for report at the next convention.

AMONG THE EXHIBITORS.

The Westinghouse interests were looked after by C. E. Frailey, C. C. Curry, H. R. Heims, H. C. Auran, W. D. McDonald and H. R. McAlmon of Minneapolis, and W. R. Pinckard, J. B. Wilkinson and Irving Cary of Chicago. Their exhibit included sections of the new Type S transformer, several styles of fan motor, small motors, luminous and non-luminous radiators, flat irons, portable indicating and integrating instruments for direct and alternating current, lightning arresters and new low-tension safety gap, Type F circuit-breaker, mercury rectifier for storage-battery charging, and tungsten lamps.

The General Electric Company was represented by W. F. Smith, C. I. Weaver and R. H. McMullen of Minneapolis, and by S. F. Dibble, E. L. Callahan and F. T. Benson of Chicago. They exhibited series and multiple tungsten lamps, portable indicating and integrating wattmeters, heating devices such as radiant toasters, coffee percolator and hot-water cup, with an abundance of pertinent printed matter.

The Central Electric Company, represented by H. W. Young and D. C. Penniman, exhibited its high-tension drop-out span protector, Pelouse-Central flatiron, P-M remote-control switch, the Central vibrator, the Central tungstometer with slide-rule attached, and the Central combined oscillating and rotating fan.

The Bryan-Marsh Company, represented by J. L. Barnard, Sam Furst and W. H. Ricker, showed a variety of tungstens, including a striking exhibit of tungsten lamps mounted on a disc revolving at 150 revolutions. Some of the printed matter excited noticeable curiosity. They also exhibited a case demonstrating the manufacture of carbon incandescent lamps.

The Allis-Chalmers Company was represented by R. H. Zavitz, R. S. Carter, Normal Stewart and R. R. Bradley.

The Electrical Engineering Company of Minneapolis had an exhibit of wiring supplies in charge of W. L. Stephenson and G. M. Darling.

The Electrical Machinery Company of Minneapolis was represented by C. H. Chalmers and A. H. Onstad.

The Northwest Electrical Equipment Company and the Columbia Incandescent Lamp Company had an exhibit in charge of W. W. Geisse.

The convention adjourned on Friday afternoon, with the general impression that the Minnesota Electrical Association was a decided success and had a useful future.

Electrically-Driven Fountain-Pen Factory.

The first fountain-pen plant in Canada has just been placed in operation by the L. E. Waterman Company, the fountain-pen makers, at St. Lambert, Quebec. The plant is entirely electrically driven, the current being generated on the premises. The generator is a Crocker-Wheeler belt-type, three-phase, sixty-kilovolt-ampere, 600-volt, sixty-cycle machine, running at 1,200 revolutions per minute, furnished by the Canadian Crocker-Wheeler Company, Limited, of Montreal. It is driven by a Bellis & Morcan English vertical engine.

RELATION OF CENTRAL STATIONS TO THE AUTOMOBILE BUSINESS.[1]

BY FRED T. KITT.[2]

We are all more or less familiar with the central-station term, "peak," which denotes the time of maximum demand upon the station for power. Ordinarily, the daily load curve of the central station approaches the peak in the early evening and usually continues but a comparatively short time.

One of the big problems, the satisfactory solution of which spells success for the central station, is the question of "peak load." It is obvious that sufficient capacity in generating machinery, prime movers, distributing copper and auxiliary apparatus must be provided to meet this maximum demand without regard to what the ordinary demand may be.

A central station which is able to so dispose of its energy that the peak load is low, compared to the continuous load, can afford to sell its products at a much lower rate than the price which must be asked by the station that has a high peak.

The occurrence of a peak may be avoided to some extent by encouraging long-hour customers, by dividing the load between the customers using power at different times of the day, and by storing energy during the hours when the rate of consumption of energy is low.

Since the electric motor has come into such popular favor, the method of dividing the load between power users which consume during the day, and lighting customers, which demand power only at night, has become almost automatic. No matter how much power load is developed, however, the peak is always noticeable. Even if the power load should exactly equal the lighting load and the time of dropping off of the one would coincide with the taking on of the other, an ideal condition which could never be realized in practice, the only result would be to flatten the peak, or, in other words, the peak would come on as the power load came on in the morning and continue until the lighting customers began to discontinue their lights at night. While this would be considered a very good load and power could be sold at a very low rate, still much of the apparatus of the station and distributing system would be idle from a comparatively early hour in the evening to the following morning. As interest charges, depreciation and other expenses come on night and day, it is desirable to keep all the equipment earning something for the full twenty-four hours.

The best solution, then, seems to be a combination of these methods. Storing electrical energy is best accomplished by means of the storage battery, although other systems have been proposed, such as pumping water from a low to a high level during hours of light load and allowing it to fall upon waterwheels during hours of heavy or peak load.

On this Coast, where a great part of the energy is produced by waterpower, the question of securing load after the evening peak is even of more importance than where fuel is used. When the peak is off in a steam plant, the fuel consumption is also less, while in a waterpower plant water usually goes to waste when the load drops off.

With our modern system of alternating-current distribution, storing energy by means of the storage battery requires not only the battery, but the converting and auxiliary apparatus as well.

Electric-vehicle batteries are nearly always charged late at night, and as the customer owns his own battery and converting apparatus and uses power at a time when both the motor consumer and the lighting customer have gone off the line, they are the most desirable customers.

Many of the central stations do not as yet make a sufficiently low rate for this class of business, which fact must be due to their not having considered the question carefully, and I think most of them could be brought to see the advantage of selling energy off the peak to be used for pleasure vehicles, delivery wagons and trucks during the day, and would make a rate low enough to encourage the adoption of electrically propelled vehicles to such an extent that their revenue would be materially increased.

It is certainly gratifying to those interested in the electric-automobile business, to know that their goods have been so perfected that they are now becoming an actual necessity, not only for the purpose of passenger transportation, but also for transporting freight on the streets of our cities.

The electric pleasure vehicle has already displaced thousands of horses, and the modern electric truck is now coming in favor so fast that it will not be long until horse-drawn vehicles will be the exception, and when we see the thousands of horses still plodding along our streets we can see the tremendous demand there will be for the product of the central station when these changes are made. It is also pleasing to us to know that the central-station people are beginning to realize the great opportunity that the electric-vehicle business has to offer them and that they are fast becoming convinced that a little effort spent in encouraging the use of such vehicles will be handsomely repaid by a permanent and desirable load connected to their mains, the securing of which requires practically no extra investment, on account of the fact that practically all the energy used for charging vehicle batteries is used when the load on a station is light and the station apparatus would otherwise be idle.

Many central stations are spending thousands of dollars for maximum-demand indicators and other devices, and are using complicated systems of accounting to improve their load factor that are now finding out that the electric vehicle, in combination with other motors, is solving the problem automatically. One customer may have a high maximum demand on a lighting load, another on a power load, another on a vehicle battery. The resultant of all these tend not only to keep down sharp peaks in the load curve, but, on account of this improvement of the load factor the station may make a lower rate on all of its energy, thus encouraging greater consumption and receiving a larger income.

The central-station people in looking back over their experiences can see where the popular use of the electric motor has enabled them to reduce the price of energy in general, and I am sure none of them regret the encouragement they offered to the power business at a time when it was not so well developed as it now is, for it has built up for them a day load which keeps the station and distributing apparatus earning something during the day as well as during the evening. And now comes the electric vehicle. During the day when the station is supplying energy for industrial purposes, and during the evening when its products are being used for lighting, the electric vehicle is busy using up energy stored the night before, and is willing to wait until the lighting customers are satisfied before again making any demand on the central station.

For this reason the central station

1. Paper read at first annual convention, Pacific Coast Electric Vehicle Association.
2. Sacramento.

should make a very low rate for vehicle battery charging, as it is by far the most desirable business that can be secured. In cases where there would be a possibility of the charging being done over the peak, a clause could be inserted in the contract whereby a penalty would be attached for using power during certain hours, which could be made large enough so that no customer could afford to take the risk of being caught violating this contract.

I understand that nearly all of the Edison companies and many other eastern companies are pushing the vehicle business to the front. Many of them have large garages for the care of their own machines and have discarded horse-drawn vehicles entirely, doing their heavy trucking as well as making their business calls by the use of electrics. In this way they not only set an example to the public but find that they save money.

The operation of a modern central station in connection with its necessary distributing business requires many vehicles of different classes, from the light runabout to the five-ton truck, and the central station should be the first to discard horses and thus hasten the day when electricity will be the only source of power used for all city transportation.

Illinois Fuel Conference.

The United States Geological Survey, acting in co-operation with the Illinois State Geological Survey and the University of Illinois, have established a "Mine Explosion and Mine Rescue Station" at Urbana, Ill. The purpose of this station is to interest mine operators and inspectors in the economic value of modern appliances as adjuncts to the normal equipment of mines. The station will also concern itself with the training of mine bosses and others in the use of such appliances. Its service is to be rendered gratuitously, and, so far as possible, to all in Illinois, Indiana, Michigan, West Kentucky, Iowa and Missouri, who may desire the benefits thereof.

In connection with this work the first conference of its kind, and which is to be followed with others in the various coal-mining sections, was held at the University of Illinois, March 11, 12 and 13. This conference was held under the direction of the Technologic Branch of the Survey, the Illinois State Geological Survey and the College of Engineering of the University of Illinois.

In the absence of President James, Dean W. F. M. Goss welcomed the visitors. Responses were made by Dr. J. A. Holmes, chief of the Technologic Branch of the Survey, who urged the co-operation of the various interests in the establishment at the University of Illinois of a school for the purpose of developing safer and more efficient methods, and G. W. Traer, representing the Illinois coal operators, who claimed that special danger of injury and death can never be entirely eliminated from coal mining and other industrial occupations, but that this danger was multiplied by ignorance, indifference and the lack of foresight. He urged that by research and application and unreserved co-operation on the part of those whose duty it is to think and apply, with those who think and experiment, conditions may be greatly improved.

The formal papers included addresses on the prevention of explosions, the chemistry of explosives, discussion of smoke suppression by prominent smoke inspectors and health officials, and a conference on the economy in the use of fuel for industrial and domestic use. This was participated in by W. L. Abbott, chief operating engineer of the Commonwealth Edison Company; A. Bement, consulting engineer, Chicago; D. T. Randall, engineer Technologic Branch of the United States Geological Survey; R. H. Kuss, assistant smoke inspector, Chicago; Edward H. Cheney, fuel engineer, Chicago; Edward H. Taylor, fuel engineer, Chicago, and J. M. Snodgrass, in charge of the fuel investigations in the engineering experiment station.

The conference was noteworthy in the fact that it brought together over 100 representatives of interests concerned in fuel production and utilization. The conference also marked the opening of the Urbana laboratory for mine-accident and mine-rescue work.

Armour Institute Branch, American Institute of Electrical Engineers.

At a meeting of Armour Institute of Technology Branch of the American Institute of Electrical Engineers, held on March 18, F. A. Lindborg, who has been associated with Geo. M. Brill, consulting engineer, Chicago, for nearly eight years, read a paper on "Industrial Engineering." He cautioned students of electrical engineering against the narrowness of overlooking other engineering lines and showed what a great importance architecture, mechanical and fire-protection engineering, for instance, have in the design of an efficient manufacturing establishment.

Before laying out an industrial plant a thorough study must be made of the process through which the work passes in its conversion from raw material to finished product. This affects the grouping and design of the buildings for the most economical handling of the product. Other features to be considered are the height of the buildings and whether they shall be of fireproof or mill construction. The relative advantages of steel, concrete and brick were pointed out and the necessity of providing abundant natural and artificial light and ventilation and thoroughly reliable protection against fire. Ample and yet economical heating means are required, as also sanitary toilet facilities. None of these features should be neglected before the plans are finished, as their provision after erection of the building usually entails considerable expense and inconvenience.

The power equipment and distribution is an important consideration. Except for a very few cases, electric-motor drive is to be recommended for factory operation. The choice of direct or alternating current depends largely upon whether variable-speed motors are required. For this service direct current is desirable, while alternating current is generally preferable for constant-speed motors, because of the simplicity and low maintenance of the induction motor. Whether individual or group drive is used depends upon the number and nature of the machines to be driven. A calibrated motor mounted on a truck is very convenient in determining the power required in driving any machine, and thus in determining the proper size of motors to be used. In changing over an old plant the total power required can be determined by indicating the engines and making proper allowance for friction losses. Attention must be given to the wiring system and to the provision on the switchboard for controlling each department from the power house.

In the power house the selection of proper equipment and its arrangement need careful consideration. Since exhaust steam for heating and also somewhat in the manufacturing processes is generally used, the installation of more expensive condensing engines is usually not warranted unless the available water supply is very abundant. Coal and ash-handling equipment, if used, must be provided for in the building construction.

New York Section, Illuminating Engineering Society.

The meeting of the New York Section of the Illuminating Engineering Society was held on the evening of March 18, at the Engineering Societies Building, with E. L. Elliott in the chair.

In order to interest both the theoretical and practical members, two papers were presented, one on "The Mathematical Theory of Finite Surface Light Sources," by Bassett Jones, Jr., and the other, "Illuminating the Editorial Offices of the New York *World*."

Mr. Jones presented a number of formulas covering the measurement of foot-candle intensities on a plane illuminated by means of a diffused source, such as lamps over glass. The material is presumed to have nearly perfect diffusion, and one square foot of its surface is taken as a unit or point source. The flux of light per unit of area will be constant, as the light sources above glass are arranged to give uniform illumination.

Formulas were also given covering a point directly below the centre of a hemispherical shell; a point directly below the centre of a flat circular source; a point directly below the centre of a rectangular source; any point under a flat circular source; any point under a hemispherical source.

The paper by Mr. Marshall was particularly interesting, as it described the first practical installation of Cooper Hewitt vapor lamps in connection with a tungsten lamp, to improve the color value.

In the editorial rooms thirty-six of these lamps were installed May 1, 1908, and the tests were made on November 17, 1908, to ascertain the variation and intensity of illumination.

A representative of the New York *World*, Mr. Thurlough, was present and spoke very highly of the "daylight" which they now had after sundown.

The following announcements were made:

The April meeting is to be held in connection with the coming exhibit of the Municipal Art Commission and the National Arts Club. The subject of "Lighting the City Beautiful" will be discussed by E. L. Elliott.

At the May meeting the idea of having two papers will be continued. They will be presented by Alfred A. Wohlauer, on "The Design and Calculation of Illumination," and L. R. Hopton, and H. E. Watkins, on "The Design of Illumination Units."

Railway Signal Association.

The regular March meeting of the Railway Signal Association was held in the Auditorium Hotel, Chicago, on Monday, March 15. At the morning session, after the presentation of several committee and sub-committee reports of progress, Prof. E. E. F. Creighton, of Schenectady, N. Y., delivered a lecture on "Lightning Phenomena, with Special Reference to Signal Circuits." The lecturer provided a number of experiments showing the nature of high-potential discharges and a number of tests on various types of lightning arresters. The equivalent needle gap of these arresters was determined under various conditions of voltage and frequency. This lecture was very similar to one given by Professor Creighton before the Western Society of Engineers on March 19.

For the afternoon programme, a novel feature had been arranged. This was a debate on the subject, "Resolved, That the Scheme of Railway Signaling Presented at the Washington Meeting is the Best Scheme of Signaling Devised to Date." On the affirmative side were W. H. Elliott, of the New York Central Lines, and C. C. Anthony, of the Pennsylvania Railroad, and on the negative, L. R. Clausen, of the Chicago, Milwaukee & St. Paul Railway, and T. S. Stevens, of the Santa Fe System. The debate hinged upon the recommendations submitted to the association as a progress report at the meeting last fall. This report was in favor of route and speed signaling, whereas the negative side contended for the latter only. According to the system advocated by the affirmative, the indications are given by the semaphore arm in the upper quadrant, using but one arm and one light. The negative side urged that there be provided two signals, a home and distant signal, using a second arm for indicating the position of the next signal ahead. At the close of presentation of arguments by the chief speakers, the subject was thrown open to general discussion, at the close of which the meeting adjourned until next June.

Subway Projects in Greater New York.

The remarkable scope of Greater New York's plans for providing adequate transportation facilities for the rapidly increasing population within its boundaries is indicated in a statement issued recently, which shows that the expenditure of nearly $500,000,000 is contemplated in schemes either already under way or under consideration by the public-service corporation. Of this amount nearly $400,000,000 is included in projects for tunnels and subways. Work involving a fourth of this total will probably be begun before the end of the present year.

Chief among these underground projects are those for the Lexington Avenue subway, which will run from the lower part of the city to its northeastern limits, forming with the present subway a huge four-tracked "X" beneath the most thickly populated district in America; for the interterminal belt line which plans to make a complete circuit of the Manhattan water front, carrying both passengers and freight to and from every important ship and railroad terminal in the city; and for the continuous transit line, which proposes an $80,000,000 system of moving sidewalks beneath the most crowded business centres of the city.

The needs of Brooklyn are partially provided for by means of the Fourth Avenue subway, which eventually will extend to Coney Island, and for the first portion of which contracts aggregating $16,000,000 have been awarded; and by means of the bridge loop scheme, now in course of construction, which will connect the three principal bridges between the two boroughs, to be supplemented later with a $35,000,000 tunnel under the East River.

Talk Electric Lighting.

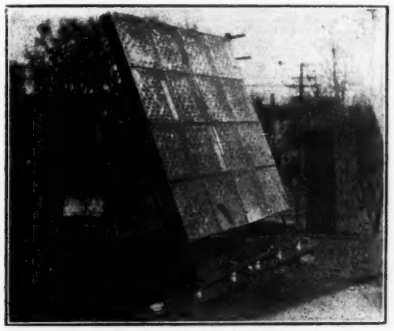
The seventh annual meeting of the Electric Lighting Engineers of New England was held at Young's Hotel, Boston, Mass., March 18. The programme included the following addresses: "Series Incandescent Street Lighting," by F. C. Sargent of Malden; "The Magnetite System of Street Lighting at Greenfield, Mass.," by G. W. Lawrence of Greenfield; "Underground Conduit Construction," by D. A. Harrington of Boston; "Some Notes on the Operation of Moderate-Sized Underground Systems," by N. T. Wilcox; "Recent Developments in Steam Turbines," by J. R. Bibbins of the Westinghouse Company; "The Curtis Horizontal Steam Turbine," by Charles B. Burleigh of the General Electric Company. The business meeting was followed by an informal dinner.

The officers of the society are: President, S. Frederick Smith of Salem; vice-president, W. H. Snow of Holyoke; secretary and treasurer, W. H. Cole of Waltham.

A Solar Electric Generator

The accompanying illustration shows a solar generator which has been developed by George H. Cove, for lighting his workshop at 486 Somerville Avenue, Somerville, Mass., with electricity.

The invention consists of a steel framework, which is placed where it will receive the direct rays of the sun. Short plugs of a metallic composition, the principle of which is held secret by Mr. Cove, are set into this framework, which is divided into sixteen squares, each square one foot in dimensions. Each square contains sixty-one metallic plugs. These plugs are set with one end under glass while the sun shines on them. The other ends are exposed to the open air and sheltered from the sun's rays. The difference in temperature of the two ends of the metallic plugs, generates a thermo-electric current, charging a storage battery. If the sun goes under a cloud and the voltage drops below that of the storage batteries, an automatic circuit-breaker breaks the circuit between the generator and the storage batteries. When the sun sets in the evening, the circuit is automatically broken.



SOLAR ELECTRIC GENERATOR.

Mr. Cove states that in his lighting installation he uses ten-volt, sixteen-candlepower tungsten lamps. The plant shown in the accompanying illustration will store in one sunny day sufficient current to light five sixteen-candlepower lamps for three nights, averaging four hours per night for each lamp.

Electric Locomotives for Michigan Central.

The Michigan Central has ordered six electric locomotives to haul all trains through the new Detroit tunnel now building, and also has an option on two more if desired. They are expected to be delivered in Detroit by September 1. The engines will be built at the shop of the General Electric Company, Schenectady, N. Y.

Glidden Tour Goes to the West.

Reports from Detroit, Mich., state that the Glidden tour will be started from that city beyond all doubt, and that the date will be July 6. It has been believed for several weeks that this city would be chosen as the starting point, and as a confirmation of this G. E. Lane, president of the Detroit Automobile Dealers' Association, has stated that he has in his possession an agreement signed by Chairman Hower of the contest committee of the American Automobile Association to the effect that Detroit would be the start of the Glidden tour.

To secure this honor for the Michigan city, Lane had to guarantee Hower that fifteen cars would be entered by Detroit automobilists, and, furthermore, had to place $3,000, covering the entry fees of the requisite fifteen machines. Lane handed eight entries to Hower, and will forward the lacking seven before the lists close. It is thought, however, that Detroit will have more entrants than the agreement calls for. The Detroit Automobile Dealers' Association has fourteen charter members and many more associate members. Each charter member is expected to enter a car, while many of the manufacturers have signified their intention of nominating two and possibly three machines. The motor-car population of the western city is enthusing over the fact that Detroit has been made the start of the 1909 road race for the Glidden trophy. Interest in the event is increasing daily, and many private owners are expected to nominate cars. Detroit is one of the largest automobile manufacturing centres in the world, and it is very fitting that it should be made the start of this year's contest.

To Sell Metropolitan Street Railway at Public Auction.

Judge Lacombe in the United States Circuit Court on March 18 handed down a decree of foreclosure and sale of the property of the Metropolitan Street Railway, New York city, in the foreclosure action brought by the Guaranty Trust Company as trustee of the Metropolitan's $12,500,000 collateral trust mortgage of 1897. The decree provides that if the railroad fails to pay into the court the sum of $13,589,270 within twenty days after the service of the order, the property of the road shall be sold to the highest bidder in front of the County Court House on June 1.

In ordering the sale Judge Lacombe rejected the elaborate provisions for the making of inventories that were included in the plans of several of the lawyers engaged in the case. He states that the annual inventories and the books of the receivers are open to all bidders, and he separates the lease of the Central Park, North & East River road and the Twenty-eighth and Twenty-ninth streets and the Fulton Street roads from the rest of the system as now being operated.

The Central Park, North & East River road is left out because its stockholders have again taken possession upon the non-payment of the rental due them. Defaults have been entered on the bonds of the Twenty-eighth and Twenty-ninth streets and the Fulton Street roads, so that those properties are out of the Metropolitan for the purposes of the sale.

It is expected that the Metropolitan Bondholders' Committee will bid in the property when it is put up for sale, but it is not thought possible to have a plan of reorganization ready by June, or any time during the summer.

Paris Telephone and Telegraph Strike.

On the evening of Friday, March 19, the Society of Paris Electricians instituted a strike, taking out of employment a large proportion of the workers in the telegraph and telephone offices, and also the carriers delivering post-office business in the French capital. During Friday the men had been quitting work all day, but it was not until evening that the service was completely tied up.

It is understood that the telegraph operators have a bitter grievance against Secretary Simyan, of the post-office department. There is hardly any business that has not suffered materially, but the strikers made an immediate concession to the government, offering to put eight telegraph operators to the government service to handle diplomatic business. Every effort is being made to hasten the completion of the wireless station between Eifel and Clifton. The Bourse in Paris and the exchanges in Marseilles, Bordeaux and Lille have been practically at a standstill, and nearly all the continental news comes to Paris by way of telephone from Berlin.

The French government has put the military forces in charge of the departments, but practically all that is being done is the repairing of cut wires, the protection of employes who have stayed at work, and the utilization of soldiers for the delivery of post-office business.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis for the month of February and two months ended February 28 compares as follows:

	1909.	1908.
February gross	$ 808,160	$ 775,454
Expenses	531,778	519,540
February net	$ 276,382	$ 255,914
Charges	234,917	233,418
February surplus	$ 41,465	$ 22,496
Two months gross	1,637,196	1,602,852
Expenses	1,076,530	1,073,899
Two months net	$ 560,666	$ 528,953
Charges	470,485	466,872
Two months surplus	$ 90,181	$ 62,081

MICHIGAN STATE TELEPHONE.

The annual report of the Michigan State Telephone Company for the year ended December 31, 1908, shows gross earnings of $3,413,280, an increase of $321,054, or over ten per cent, as compared with 1907. Net earnings for the year were $911,429, an increase of over eighteen per cent. Dividends of six per cent on the preferred, and four per cent on the common stock are being paid.

N. W. Harris, chairman of the board of directors, says: "The year just passed has been the most satisfactory in the history of the company."

DENVER GAS AND ELECTRIC.

The Denver Gas and Electric Company's report for the year ended February 28, 1909, shows earnings compared as follows:

	1909.	1908.
Gross	$2,202,074	$2,013,000
Expenses	1,256,484	1,197,953
Net	$ 945,590	$ 815,047
Charges	384,302	376,413
Surplus	*$ 561,288	$ 438,634

*Equals 16 per cent earned on the $3,500,000 capital stock outstanding. Has paid 6 per cent since July, 1907.

AMERICAN TELEPHONE.

The American Telephone and Telegraph Company reports for the month of February and two months ended February 28, 1909, compared as follows:

February:	1909.	1908.
Dividends	$1,031,806	$ 936,414
Interest and other revenue	517,570	818,812
Telephone traffic (net)	326,995	309,330
Real estate	9,490	2,219
Other sources	78,547	35,981
Total earnings	$2,264,309	$2,102,759
Expenses	167,381	181,029
Net earnings	$2,096,928	$1,921,730
Interest charges	780,834	647,546
Surplus	$1,316,094	$1,274,184
January 1 to February 28:		
Dividends	$3,713,106	$3,403,566
Interest and other revenues	1,711,300	1,656,080
Telephone traffic (net)	719,495	697,830
Real estate	17,552	18,226
Other sources	204,760	117,552
Total	$6,366,215	$5,893,257
Expenses	348,055	341,311
Net	$6,018,160	$5,551,946
Interest	1,554,844	1,280,940
Surplus	$4,463,315	$4,271,105

MISSOURI & KANSAS TELEPHONE COMPANY.

The Missouri & Kansas Telephone Company, the Bell subsidiary, operating in Missouri and Kansas, has issued its annual report for the year ended December 31, 1908. The income account compares as follows:

	1908.	1907.
Gross	$2,653,148	$2,428,893
Expenses	2,161,868	1,710,071
Net	$ 491,280	$ 688,822
Interest and reserve	761,607	688,402
Deficit	$ 270,327	*$ 420
Dividends	.....	.....
Deficit	$ 270,327	*$ 420
Previous surplus	10,258	9,838
Net deficit	$ 260,069	*$ 10,258

*Surplus.

CHICAGO CITY RAILWAY COMPANY.

The Chicago City Railway Company's annual report for the thirteen months ended January 31, 1909, compares with the previous report, which covered eleven months to December 31, 1907. The comparisons follow:

	13 Months Ended Jan. 31, 1909.	11 Months Ended Dec. 31, 1907.
Passenger receipts	$8,979,735	$7,460,634
Other sources	216,047	102,059
Total	$9,195,782	$7,562,693
Exp., taxes, renew., interest	8,169,494	6,410,272
Net earnings	$1,026,288	$1,152,421
City, 55 per cent	564,458	633,831
Company, 45 per cent	$ 461,830	$ 518,589
Interest on capital	1,732,446	1,116,386
Income from operation	$2,194,276	$1,634,975
Other income	655,206	281,581
Total income	$2,849,482	$1,916,558
Interest on bonds outst	849,739	.....
Net income	$1,999,743	$1,916,558
Dividends	1,620,000	1,215,000
Surplus	$ 379,743	$ 701,558
Per cent net to stock	11.11	10.64

Fare passengers carried were 180,243,173, or 2.9 per cent gain over the previous year; transfer passengers, 111,977,693, or 6.9 per cent gain; fare and transfer passengers, 292,220,866, or 4.4 per cent gain; percentage of transfer to fare, passengers, 62.13; double-truck cars, 805; single-truck cars, 251; total cars required by ordinance, 1,056; miles of single track owned, 252.29.

President Mitten says:

"The report covers thirteen months. The extra month is due to the fiscal year having been changed to January 31, to conform with the close of the operating year, as prescribed by the settlement ordinance.

"Fifty-four-and-twelve-hundredths miles of track have been reconstructed during the past year under the provisions of the settlement ordinance, of which 22.91 miles represent replacement of cable tracks removed. The ordinance requires 94.71 miles of track to be reconstructed by April 15, 1910, of which 81.20 miles have been reconstructed, leaving but 13.51 miles to be reconstructed during the coming year. In addition to the foregoing, 7.99 miles of new track have been constructed since January 1.

"The remainder of the 300 pay-as-you-enter cars purchased in 1907 have been placed in service, and 152 of the 300 cars purchased during 1905 and 1906 have been remodeled for pay-as-you-enter service. Two new car stations of large capacity and modern equipment have been built during the year. There are now four such stations, with total housing capacity approximately 1,100 cars.

"On June 1, 1908, an advantageous agreement was entered into with the Commonwealth Edison Company, whereby our company will purchase for a period of at least ten years all of the electrical energy used in the operation and maintenance of its railway system. A new substation has been built during the year and new rotary converters are now being installed therein. There are now four such substations, with a total manufacturers' rated capacity of 36,000 kilowatts. Additional rotary converters have been installed in each of the other substations, also an additional rotary converter and a large storage battery have been added to the railway company's equipment in the Plymouth Place substation of the Commonwealth Edison Company. A new underground conduit system for distribution of power has practically been completed and the installation of cables therein is well under way. Material improvements in fire risk at various buildings of the company have been effected, which have considerably decreased liability of loss by fire."

INTERNATIONAL TRACTION OF BUFFALO.

The International Traction Company of Buffalo report for the year ended December 31, 1908, compares as follows:

	1908.	1907.
Gross	$5,226,983	$5,445,070
Expenses, taxes and deprec.	3,531,855	3,652,602
Net	$1,695,128	$1,792,468
Fixed charges	1,522,837	1,480,207
Surplus	*$ 172,291	$ 312,261

*Equal to 3.44 per cent earned on the $5,000,000 4 per cent cumulative preferred stock.

President Thomas Penney says:

"The high standard of service given to the public has been carefully maintained, and improvements in the equipment and transportation facilities have been made consistently with the established policy of the company. The pay-as-you-enter cars have demonstrated their advantages for quicker and safer transportation, and there are now eighty of this type in serv-

ice. Additional lines will be furnished with this improved equipment during the current year.

"The integrity of the property has been fully maintained. Liberal appropriations were made from income to the fund for depreciation to cover expenditures on account of extensive renewals and replacements of track, paving, rolling stock and other equipment."

ELECTRIC STORAGE BATTERY COMPANY.

The annual report of the Electric Storage Battery Company, of Philadelphia, for the year ended December 31, 1908, compares as follows:

	1908.	1907.
Gross	$ 845,705	$1,075,226
Operating expenses	315,180	387,021
Net	$ 530,525	$ 688,205
Other income	106,054	133,069
Total net income	$ 636,579	$ 821,274
Dividends	528,092	812,450
Net surplus	$ 108,487	$ 8,824
Previous surplus	3,669,327	3,754,451
Less adjustments	*1,774,136	93,930
Total surplus	$2,003,678	$3,669,327

*Includes depreciation of Electric Vehicle Company securities, $1,940,000, and sundry adjustments of accounts not incident to the current year, $57,586, less increment from appraisement of factory plant above book valuation, $223,450.

KNOXVILLE RAILWAY AND LIGHT.

The Knoxville Railway and Light Company reports earnings for February and two months ended February 28, 1909, compared as follows:

	1909.	1908.
February gross	$43,867	$42,990
Expenses and taxes	22,601	23,309
February net	$21,265	$19,681
Interest	11,483	11,398
Balance	$ 9,782	$ 9,282
Reserve for emergency fund	.....	.....
February surplus	$ 9,782	$ 8,282
Two months gross	$92,084	$81,495
Expenses and taxes	47,269	50,094
Two months net	$44,814	$31,401
Interest	22,966	22,845
Balance	$21,848	$ 8,555
Reserve for emergency fund	.....	.....
Two months surplus	$21,848	$ 8,555

BIRMINGHAM RAILWAY, LIGHT AND POWER.

The Birmingham Railway, Light and Power Company reports earnings for February, 1909, and two months ended February 28, 1909, compared as follows:

	1909.	1908.
February gross	$177,453	$167,341
Expenses and taxes	108,447	109,848
February net	$ 69,006	$ 57,493
Interest and sinking fund	44,785	43,524
February surplus	$ 24,220	$ 13,969
Two months gross	$369,797	$345,087
Expenses and taxes	228,082	235,651
Two months net	$141,714	$109,436
Interest and sinking fund	89,568	87,304
Two months surplus	$ 52,145	$ 22,131

UTICA & MOHAWK VALLEY.

The report of the Utica & Mohawk Valley Railway Company for the quarter ended December 31, 1908, compares as follows:

	1908.	1907.
Total railway operating rev.	$269,524	$272,418
Total railway operating exp.	167,183	159,500
Net railway operating rev.	$102,341	$112,917
Taxes accrued	10,195	9,054
Operating income	$ 92,146	$103,862
Other income	2,110	32,963
Gross income	$ 94,256	$136,826
Total deductions from gross inc.	40,377	40,377
Net corporation income	$ 53,879	$ 96,448

MEMPHIS STREET RAILWAY COMPANY.

The Memphis Street Railway Company reports earnings for February and two months ended February 28, 1909, compared as follows:

	1909.	1908.
February gross	$118,091	$112,646
Expenses and taxes	76,788	75,197
February net	$ 41,303	$ 37,448
Interest	35,250	34,450
Surplus	$ 6,052	$ 2,997
Reserve and emergency fund	2,500	2,500
February net surplus	$ 3,552	$ 497
Two months gross	246,561	231,406
Expenses and taxes	161,818	153,759
Two months net	$ 84,742	$ 77,647
Interest charges	70,851	68,950
Surplus	$ 13,891	$ 8,697
Reserve and emergency fund	5,000	5,000
Two months net surplus	$ 8,891	$ 3,697

NORTHERN OHIO TRACTION.

The report of the Northern Ohio Traction and Light Company for the month of February and two months ended February 28, 1909, compares as follows:

	1909.	1908.
February gross	$136,504	$119,301
Expenses	80,542	78,466
February net	$ 55,963	$ 40,835
Charges	43,731	43,755
February surplus	$ 12,232	*$ 2,920
Two months gross	$284,399	$245,426
Expenses	165,251	160,358
Two months net	$119,148	$ 85,068
Charges	87,183	87,642
Two months surplus	$ 31,965	*$ 2,574

*Deficit.

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of February and five months ended February 28, 1909, compares as follows:

	1909.	1908.
February gross	$ 284,090	$ 270,224
Expenses	199,912	201,449
February net	$ 84,178	$ 63,775
Charges	32,036	32,947
February surplus	$ 52,141	$ 35,828
Five months gross	$1,514,614	$1,458,463
Expenses	959,552	943,476
Five months net	$ 555,062	$ 514,987
Charges	145,341	148,135
Five months surplus	$ 409,731	$ 366,852

BELL TELEPHONE OF MISSOURI.

The Bell Telephone Company of Missouri has issued its annual report for the year ended December 31, 1908. The income account and general balance sheet compares as follows:

Income account:

	1908.	1907.
Revenue	$2,009,355	$1,933,429
Expense, tax mainten., etc.	1,346,960	1,392,501
Net revenue	$ 662,375	$ 540,928

The comparative general balance sheet as of December 31, 1908, shows:

ASSETS.

	1908.	1907.
Const. and property Jan. 1.	$7,745,316	$6,587,165
Construction for year	253,785	1,173,638
Supply department	200,673	274,475
Real estate	609,006	598,946
Stocks and bonds	2,051	2,051
Bills and accts. receivable	520,927	254,692
Cash	201,226	169,862
Total	$9,532,986	$9,060,831

LIABILITIES.

Capital stock	$5,779,800	$6,760,000
Capital stock, installments	.....	1,242,140
Surplus	419,504	419,097
Accounts payable	272,423	602,084
Reserves	61,258	37,509
Total	$9,532,986	$9,060,831

MICHIGAN STATE TELEPHONE.

The Michigan State Telephone Company has issued its full pamphlet report for the year ended December 31, 1908. The income account compares as follows:

	1908.	1907.
Gross	$3,413,280	$3,092,226
Expenses and taxes	2,501,851	2,316,442
Net	$ 911,429	$ 775,784
Special exp. and bond disct.	29,229	28,475
Net	$ 882,200	$ 747,308
Interest	417,595	414,776
Surplus	$ 464,605	$ 332,532
Dividends paid	*206,128	*205,815
Surplus	$ 258,128	$ 126,717
Previous surplus	584,968	460,668
Total surplus	$ 843,096	$ 587,385
Deductions	202,307	2,417
Profit and loss surplus	$ 641,138	$ 584,968

*Includes common dividend, $69,170.

Surplus, after payment of six per cent dividends on the preferred stock, is equal to 5.45 per cent earned on the $6,000,000 common stock.

LONDON UNDERGROUND.

The Underground Electric Railways of London report gross earnings for the week ended February 27 and eight weeks ended February 27, 1909, compared as follows:

	1909.	1908.
Bakerloo	£ 3,420	£ 3,130
Piccadilly	5,300	5,510
Hampstead	3,790	3,180
District	9,703	9,093
Tramways	4,650	5,243
Total	£ 27,368	£ 26,156
Total, eight weeks	223,038	205,433

The Underground Electric Railways of London report gross earnings for the week ended March 6 and nine weeks ended March 6, 1909, compared as follows:

	1909.	1908.
Bakerloo	£ 3,505	£ 3,125
Piccadilly	5,855	5,430
Hampstead	3,725	3,170
District	9,381	9,157
Tramways	4,014	5,192
Total	£ 26,480	£ 26,074
Total, nine weeks	£249,518	£231,507

WILKESBARRE GAS AND ELECTRIC.

The Wilkesbarre Gas and Electric Company's report for the year ended December 31, 1908, compares as follows:

	1908.	1907.
Gross	$396,301	$361,349
Expenses	206,785	188,029
Net	$189,516	$173,320
Interest on bonds	118,678	111,789
Surplus	$ 70,838	$ 61,531
Dividends	60,000	45,000
Net surplus	$10,838	$ 16,531

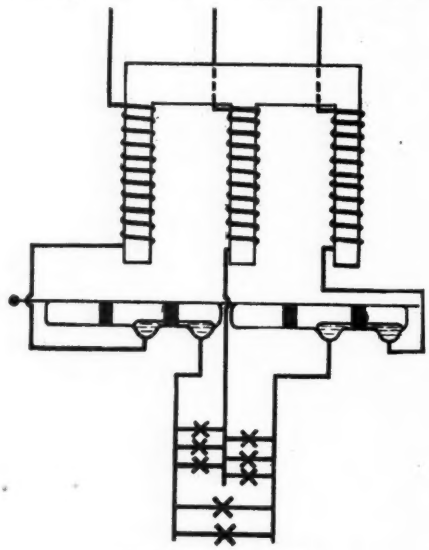
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

NEW PROCESS OF UTILIZING ATMOSPHERIC NITROGEN.

In this process, which has been developed by the Westdeutsche Thomas Phosphat Werke, of Berlin, a certain quantity of combustible vapor or gas, as ether vapor, or, better, hydrogen (prepared by electrolysis of water), is added to the air to be subjected to the electric discharges. The explosion produced under these conditions is attended by a sudden rise in temperature, which is favorable for the formation of a large proportion of dioxide of nitrogen. As this temperature rise is almost instantaneous, there is no time for the dioxide formed to decompose. An excellent output is said to be obtained in this manner, but it remains to be known if the process is economical. Dr. Platsch realizes the same sudden temperature rise, followed by instantaneous cooling, by blowing pulverized peroxides, which easily give off oxygen, into the arc burning in the air. The reduced oxides can be easily separated from the mixture of nitrate and nitrate of lime when the gas is saturated by the lime, and be oxidized anew and used again in the manufacturing process.—*Translated and abstracted from Journal du Four Electrique et de l'Electrolysis, February, 1909.*

CURRENT LIMITERS.

A method of charging for current has been extensively adopted in Germany, especially by smaller central stations, under which the consumer pays for a certain maximum current consumption or number of lamps, beyond which he is not entitled to take current from the line. This system is very economical, as it greatly simplifies the billing and also does away with the expense of purchasing and maintaining meters. Naturally, the central station must be protected against the consumer's taking more current than agreed, and the current limiters of the Dr. Paul Meyer Company, of Berlin, are intended to serve this purpose. In one type of this device, suitable for current intensities up to twelve amperes, the current to be consumed flows through a solenoid, which produces a strong magnetic field in a soft-iron core. An armature is movably connected to a flat spring, and a glass tube, partly filled with mercury and bulging out at the two places where it receives the current, is rigidly fastened to the armature. To prevent oxidation, the tube is filled with a neutral gas and hermetically sealed. Solenoid, glass tube and the consumer's circuit are connected in series. The ampere turns of the solenoid are kept at a minimum and so dimensioned that the armature is attracted when the current agreed upon is exceeded by ten per cent; this causes the mercury to be parted and the current to be interrupted. The magnetic field then disappears and the armature drops, whereby the circuit is again closed and



CURRENT LIMITER.

the armature attracted. This process is repeated and the consumer is compelled to reduce the current to the amount agreed upon. The adjustment to the desired current strength or number of lamps is effected by regulating the tension of the spring to which the armature is attached. The devices are also made with two-pole magnets for direct and alternating-current, three-wire systems. Recently a three-pole apparatus for polyphase current has also been perfected, which has three solenoids and two glass tubes, connected as shown in the accompanying illustration. Its object is to disconnect the entire installation as soon as the load on any one of the phases exceeds the amount agreed upon.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), February 18.*

READING RADIOGRAMS RECEIVED BY ELECTROLYTIC DETECTORS WITHOUT EAR TELEPHONES.

Radiograms received by electrolytic detectors are read by a telephone, which the operator is obliged to keep constantly to his ear, as the sounds are very feeble. To do away with this inconvenience, Paul Jegou has designed an arrangement which makes it possible to hear the sounds throughout a large room. The fine-wire winding (R = 450 ohms) of a telephone transformer coil is connected to the circuit of the electrolytic detector and the telephone to the thick-wire winding (R = three ohms). A carbon rod is placed perpendicularly on the diaphragm, so that it rests in about the centre with one of its ends, the other end entering into a carbon socket. A second telephone receiver of rather low resistance is then connected in the circuit formed by this microphone and an accumulator cell. When the detector is exposed to waves sufficiently strong to cause the first telephone to emit a sound, the second telephone also vibrates and emits a sound that can be easily heard all over a large room. It is evident that this arrangement may also be used as a telephone relay, but experiments have demonstrated that there is a narrow limit to this cascade connection; it is not practicable to apply the reinforcement more than two times without destroying the regularity and safety of operation of the device.—*Translated and abstracted from L'Electricien (Paris), February 27.*

ASTATIC DIRECT-CURRENT MOTOR-METER.

Astaticity in direct-current motor-meters is obtained by employing two armatures working in unison. These may be of the drum or ring type. They are placed on a common shaft and are arranged either above or below two main-current coils, or within two pairs of coils. Each two armature coils are connected in series or parallel in such a way that their lines of force assume opposite directions. The combined connection of all the armature coils may be open or closed. The ends of the windings are conveniently joined to an exchangeable commutator. The astaticity becomes nearly absolute if the armatures are constructed in the form

of discs and placed as close to each other as possible. The current coils then receive a flat shape, and the armatures are provided with iron cores. As a meter of this kind is not influenced by external fields, the magnetic field produced by the main-current coils may be weak. The drop in tension thus becomes very small, about 0.04 volt at 100 amperes, and this makes it possible to connect the meter in shunt with the main circuit. The use of shunts, which was formerly not practicable on account of the great loss in tension, results in several advantages. It is no longer necessary to lead a heavy conductor to the meters; a shunt may be inserted at any place. Milli-voltmeters may also be connected to the same. The meters are not influenced by the bus-bar fields. Only one model has to be manufactured for different current strengths, it being sufficient to change the shunts for the different current intensities.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), February 25.*

ELECTRICAL EQUIPMENT IN A LONDON DEPARTMENT STORE.

On March 15, there was opened by Selfridge & Company a large department store in London, which has created considerable comment, since it is designed not only on American ideas in merchandising, but is equipped also with many features that are to be met with in the newest American establishments of this kind. The electric-lighting equipment is very complete. About 6,000 incandescent and 286 arc lamps are installed. Among the incandescents are a large proportion of tantalum and tungsten lamps. The current is supplied from a nearby central station and is distributed from a large switchboard in one of the sub-basements. The lighting throughout the store is carried out on modern illuminating lines and the fixtures throughout are both artistically and scientifically arranged. A very effective store-window lighting has been carried out, and a novel system of lighting the showcases along the main aisles. All the wiring throughout the building is in conduits. There are a great many motors used throughout the establishment. Aside from the electric elevators, there are motors for ventilating fans, sprinkler pumps, hot-water pumps, a motor for operating the pneumatic-dispatch system, and vacuum-cleaner outfits, pattern-cutting machines, electric hair-drying machines, ice-breaking machines and knife-cleaning machines. There are nine electric passenger and two freight elevators equipped by the Otis Elevator Company. Each passenger elevator is provided with flash-light up and down signals, such as are quite common in American office buildings. There is a gravity package conveyor that consists of a large tube with a smaller inner column, about which is a spiral chute. Packages are placed in this chute at any of the floors and descend by gravity to the shipping rooms in the basement. A private-telephone exchange, with sixty trunk lines and 400 local stations has been installed. An interesting system by means of which a department chief may be called when not at his desk has been provided. This consists of a number of colored lights placed conspicuously near the clock in each room. The operator, on finding that the person called for is not at his usual desk, signals for him with a particular colored light, so that he may answer from the nearest telephone. A comprehensive system of electric clocks has been installed, all working from one master clock, which operates nineteen clocks situated on the different floors of the building. Connected with these clocks is a system of electric bells for automatically announcing the time of meals and the time of opening and closing business. A very complete sprinkling and fire-protection system has been put in. The sprinklers are set to go off at 155° F. so as to deal with a fire while it is in its incipient stage. Thirty-six fire hydrants are provided at various landings on the stairways of the building.—*Abstracted from the Electrician (London), March 5.*

Single-Phase Abandoned on Milwaukee System.

Reports have been circulated recently that the Milwaukee Light, Heat and Traction Company, after experiments with various systems on its remote interurban lines, has decided to abandon the use of equipments adapted for operation on both direct-current and single-phase alternating-current. Requests were made to President John I. Beggs, of the company, for a statement of the facts in the matter and a brief summary of the reasons on which the decision was based. Extracts from Mr. Beggs' reply follow:

"The newspaper reports to the effect that we were for the time being going to discontinue the use of alternating-current, direct-current, single-phase equipment on our outlying long-distance interurban lines are correct. I have been forced to this action very reluctantly as this type of apparatus is, in my judgment, a commercial operating necessity through sparsely settled territory on long outlying lines, the amount of business on which does not justify the maintenance of substations at frequent intervals requiring constant manual attendance. The alternating-current, direct-current equipment does fairly well when operating as single units, but on our lines, during seasons of heavy traffic, we are compelled to attach anywhere from one to three large trailers which the alternating-current, direct-current, single-phase apparatus has not the power of starting.

"We are substituting for the alternating-current, direct-current equipment the 600-1,200-volt system which reduces very considerably the objectionable feature of substations at such frequent intervals. We have arranged with the General Electric Company for thirty four-motor equipments of this type to replace fifteen four-motor alternating-current, direct-current, single-phase equipments operated by us for nearly two years past and fifteen additional 600-1,200-volt equipments to be placed on fifteen new interurban cars now being built for us by the J. G. Brill Company. This new type of equipment we expect to have installed and in operation within the next two or three months."

The 600-1,200-volt equipments referred to are on the straight direct-current system.

A Commercial and Illuminating Engineering Department.

The West Penn Electric and Railways Company, Connellsville, Pa., has established a new department to be known as "The Commercial and Illuminating Engineering Department." The object of the department is to render advice, gratis, to all users of West Penn current, including architects and electrical contractors, on matters pertaining to lighting and power. The department is in charge of E. J. Mara, consulting engineer, formerly illuminating engineer, for the company.

Pacific Telephone Bonds.

Negotiations have been closed for the purchase of $15,000,000 bonds of the Pacific Telephone and Telegraph Company. These securities are part of the $35,000,000 first and collateral trust four per cent bonds, of which $10,000,000 are now outstanding. Part of the proceeds from the new issue will be used for retiring maturing obligations, while the remainder is to be devoted toward extensions and improvements of the company.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Industrial Turbine Development.

The Portland Cement Company, of Portland, Colo., has purchased a 600-kilowatt, three-phase, sixty-cycle Westinghouse turbo-generator equipment, with a Le Blanc condenser, a rotary converter and a switchboard. These are to be installed as an addition to the present plant, and will serve rather as a gain in economy than in output. This will give an increased power capacity to be used on additional grinding machinery. The turbine and condenser are now being built by the Westinghouse Machine Company and the electrical apparatus by the Westinghouse Electric and Manufacturing Company.

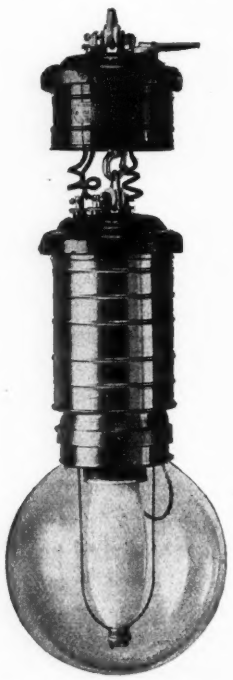
The installation of the Le Blanc condenser makes it possible to utilize for condensing purposes water from an old well which is not now usable with the present type of surface condenser. This will save the company a comfortable sum on its water-supply reservoir and pipe lines.

It is interesting to note that turbines have been adopted in this plant for power extension, rather than Corliss engines, two of which have already been operating for a number of years with surface condensers. The fuel used is a Southern Colorado bituminous coal of rather poor quality. With the moderate superheat and high vacuum contemplated, it will thus be possible for the turbine to effect considerable economy in operation. Although direct current is largely used at this plant, an alternating-current turbine unit was selected in connection with a rotary converter, as providing greater flexibility of operation than obtainable with a direct-current turbine unit, which was also under consideration.

The purchase of a 750-kilowatt, two-phase, thirty-cycle, 440-volt turbo-generator set by the Lyman Mills of Holyoke, Mass., is an indication of the satisfaction which electrical apparatus has given in this textile mill. For some years Westinghouse induction motors have been installed throughout the mill to drive the various machines, with a total capacity of 900 horsepower, and have given entire satisfaction. Recently the company decided to install additional generating capacity, and purchased a turbine from the Westinghouse Machine Company designed for 150 pounds steam pressure with fifty degrees superheat and twenty-eight inches vacuum. This turbine unit is now being built at the Westinghouse shops, East Pittsburg, Pa.

A New Arc Lamp for Twenty-five Cycle Circuits.

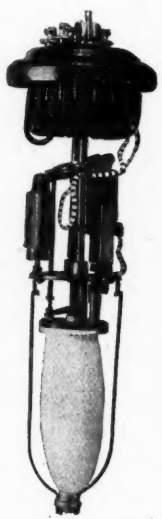
The pulsations of a twenty-five-cycle enclosed carbon arc are visible to the eye. Light emanating from such a source cannot be considered satisfactory for many classes of artificial illumination, and will not ordinarily be used in any case where a more suitable circuit is available.



ENCLOSED ARC LAMP FOR TWENTY-FIVE-CYCLE CIRCUITS.

With the more extensive use of a lower frequency alternating current for railroad and stationary motor power, there are parks, railroad terminals, factory buildings, and factory yards to be lighted. For such general illumination the twenty-five-cycle enclosed arc is being used and considered satisfactory. Heretofore, the only enclosed arc lamp available has been a modification of some lamp designed for higher frequency circuits, such modifications consisting of the use of extra or more flexible springs to take up the extreme vibration of the mechanism. A construction embodying the use of very light springs is questionable, as such springs must stand the strain caused by the inrush of starting current.

Fig. 1 shows the external appearance, and Fig. 2 the mechanism of a lamp designed by the General Electric Company, Schenectady, N. Y., to meet these exacting requirements. The frame is of the well-known two-rod type. The mechanism consists of a rocker frame carrying the lamp magnet and suitable current-adjusting counterweight. The armature is of standard laminated construction, but is stationary and held rigidly to the lamp-base casting. By the use of this considerable weight in the moving element, and by making the armature a part (mechanically) of the lamp frame, all objectionable vibration is absorbed or deadened, thereby permitting the elimination of all springs. The lamp is as quiet and free from vibration in starting and operating as standard lamps for higher frequencies.



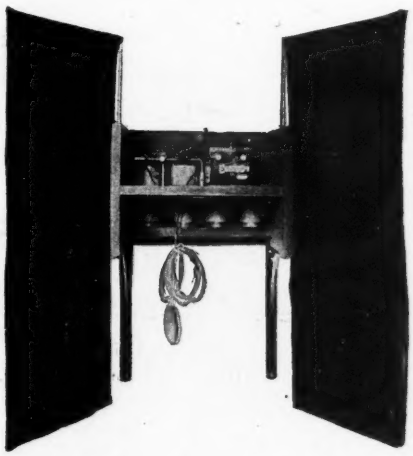
MECHANISM OF ENCLOSED ARC LAMP FOR TWENTY-FIVE-CYCLE CIRCUITS.

Where this lamp is to be operated on 220 or 440-volt circuits an external as well as internal compensator must be used (Fig. 1), and a third binding post placed on the lamp top, while for nominal 110-volt circuits the lamp is self-contained.

A High-Potential Testing Apparatus for Lamp Makers.

The Dwyer Machine Company, Lynn, Mass., has placed on the market a machine for testing the degree of vacuum in the bulbs of incandescent electric lamps. The principle upon which the operation of the apparatus is based is the facility with which a high-potential discharge passes in an attenuated atmosphere. The potential impressed is within the vicinity of 20,000 volts, and according to the density of the gas in the bulb the following characteristics are said to be observed:

(1) A lamp containing a considerable amount of air shows purple streamers branching from the filament to the glass. Such a lamp probably contains a crack in the glasswork and will burn out in a minute or two.



APPARATUS FOR TESTING THE VACUUM IN THE BULBS OF INCANDESCENT LAMPS.

(2) A red glow uniformly distributed throughout the bulb indicates a better vacuum than the above. This lamp contains some air, and the candlepower will drop very rapidly, probably to ten candlepower within an hour.

(3) A lamp with a white glow with the slightest tint of pink close to the glass is slightly better than the above.

(4) A lamp with a whitish glow, but showing the filament very distinctly and with a marked glow about the joints, while containing a better vacuum than the above, is still a very poor lamp and will deteriorate very rapidly.

(5) A lamp with a white glow uniformly distributed throughout the bulb may burn a hundred or two hundred hours without burning out, but the candlepower will drop rapidly.

(6) A lamp with a thin whitish glow more or less intermittent and sometimes hard to start is a lamp which most lamp manufacturers pass as O. K. After such a lamp has burned for about half an hour the glow will usually be found to have disappeared. Such a lamp will drop in candlepower much more rapidly than a lamp with a perfect vacuum.

(7) A lamp which shows an intermittent flicker of light on the inside surface of the bulb contains a very good vacuum. Such lamps are universally passed as excellent by lamp manufacturers.

(8) A lamp which shows no glow whatever possesses a still higher degree of vacuum than the above, and as this "glow test" is the most severe test known for vacuum it is as high as the lamp manufacturers can obtain, and such lamps may be considered perfect.

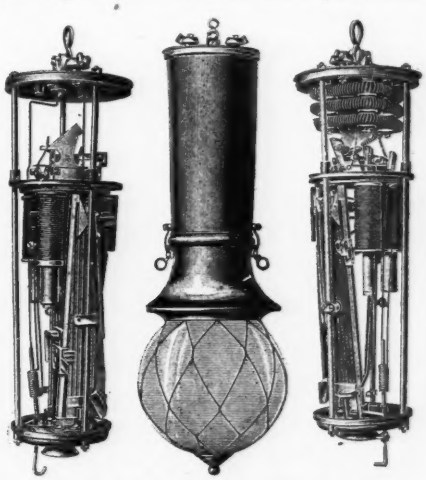
(9) A lamp which is completely full of air cannot be made to glow.

A Magazine Flaming-Arc Lamp.

To overcome the tendency toward unsteadiness of the arc in a flaming-arc lamp it is customary to make the carbons of small diameter. Their quick consumption, however, necessitates a great length of carbon and therefore a long lamp in order to obtain a reasonably long run on one trimming. A successful attempt has been made to overcome this defect by the construction of a magazine for each carbon group, so that when one pair of carbons is consumed another is automatically substituted. This construction is embodied in the "Angold" flaming-arc lamp, manufactured by the General Electric Company of Great Britain in its works at Salford. A description of this lamp appeared in a recent number of *Electrical Engineering* of London.

The provision of the magazines, each of which contains nine carbons, enables one set of carbons to be used after another till all are consumed. Since each set of carbons burns about six hours, the lamp burns close to fifty-five hours on one trimming. The lamp is but thirty-eight-and-one-half inches over all, which is quite a moderate length for a flaming-arc lamp. By making the contact with the carbons close to their burning ends, the expense of copper-covered carbons is avoided. Contact is made with each carbon by means of a heavy copper block whose nose is driven by a weighted lever along a line at about forty-five degrees to the carbon.

The mechanism for feeding the carbons consists of a forcing crossbar that operates small traveling catches that engage the tops of the carbons. The bar is forced downward step by step on a rack by a shunt solenoid which is intermittently energized by a make-and-break device. The negative magazine is pivoted to swing freely, and when pulled toward the fixed positive magazine the make-and-break device is released and continued feeding goes on until the arc is of the proper length to permit the negative magazine to swing back. The carbons are fed down at the same speed at which they are consumed. When their ends are pushed below the magazines the next two carbons take up their positions directly behind the burning ends. At this point the feeding gear is automatically reversed and the crossbar raised step by step to the top of the magazine. On reaching the top another reversal takes place and



MAGAZINE FLAMING-ARC LAMP.

the catches engage the top of the new carbons and begin to force them down. This pushes out the short burning ends and puts the new carbons into action. For an interval of some seven seconds after the ends have been ejected the arc goes out, but an equivalent resistance is automatically cut into the circuit so that other lamps in series are not affected.

Across the lamp terminals the pressure is about forty-two volts. In a ten-ampere lamp the feed occurs once every two minutes. The positive carbon is twelve inches long and eight millimetres in diameter. It alone is impregnated. The negative carbon is a trifle smaller in diameter. The end views in the accompanying illustration show the mechanism of the lamp from opposite sides. The right-hand view is of a lamp in which the cut-out and equivalent resistance are included in the upper chamber of the lamp; otherwise it is identical with the lamp shown on the left.

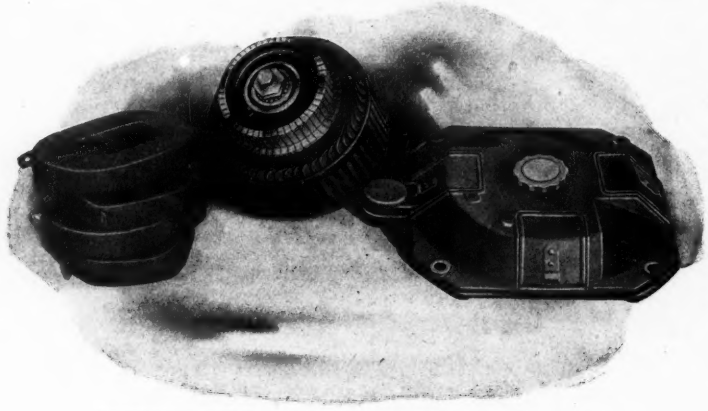
A Difficult Power Problem and Its Solution.

It was early apparent to those familiar with the varied needs of mining that electricity would eventually play a most important part in the work. But progress was relatively slow, due to the failure of designers of electrical equipment to realize the conditions which they must meet.

In the coal-mining industry two types of machines have been prevalent; the so-called breast machine, with which the cutting is done by knives or chisels rigidly held on a moving chain, and the puncher machine in which a pick is given a reciprocating motion and strikes successive powerful blows against the coal. The application of the electric motor for driving the chain machine was comparatively simple, for the rotative motion of the motor readily lent itself to driving the chain through the medium of gears.

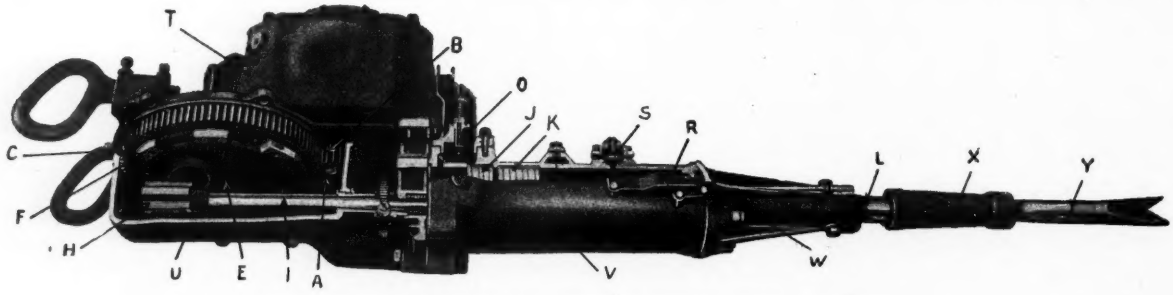
But the problem of utilizing a motor to give reciprocating motion to a pick was more difficult of solution. Evidently, in a percussive tool the vibrations, if transmitted direct, would be destructive of the motor. While the problem has been attacked from almost every conceivable point and upon every conceivable basis, experience has apparently demonstrated that in order to give sufficient flexibility the blow itself must be struck through the medium of compressed air. In the development of the electrically-driven puncher, here described, the compressor cylinder has been retained and different means of compressing the air have been devised. This machine, built by the Pneumelectric Machine Company of Syracuse, N. Y., and illustrated herewith, comprises within the same frame the electric motor and the air cylinder. In its design and construction it displays many novel and ingenious features of interest to the electrician, the engineer, and the mechanic.

The driving motor, which is of the ordinary series-wound four-pole type, possesses no unusual features tending to make it complicated or requiring special generators for supplying current; but is designed along standard lines with particular care in reference to the work imposed upon it. This motor, whose shaft is vertical, is completely enclosed, the motor frame and gear-case cover being made in one piece of cast steel. By this means, strength, minimum weight and simplicity are secured. Support for the upper or commutator end of the motor shaft is furnished by a Hess-Bright radial ball bearing. At the lower end is provided a ball-thrust bearing for taking the weight off the armature, and also a long bronze-bushed bearing for taking up the lateral thrust due to the motor drive.

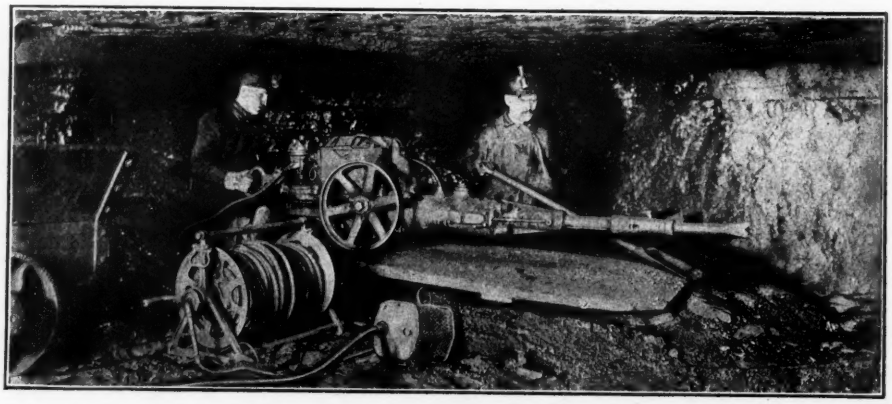


SHOWING DETAILS OF PNEUMELECTRIC MOTOR.

On account of the necessity of employing an enclosed motor the matter of ventilation and cooling of the various parts became an important matter for consideration. It is accomplished in the following manner: The air to be compressed is drawn in through the armature and field windings at each forward stroke of the air-compressing piston. By this means about twenty-eight cubic feet of cool air per minute pass over the heated parts at a velocity of about two-and-one-half



PARTIAL SECTIONAL VIEW OF PNEUMELECTRIC COAL PUNCHER.



THE PNEUMELECTRIC COAL PUNCHER IN OPERATION.

feet per second. This method has been found very effective, and is at the same time entirely automatic, requiring no auxiliary appliances.

The insulation on the field coils and armature windings is of the highest insulating and water-resisting quality. The commutator is made of drawn bars of solid copper, mica segments, micanite insulation, etc., in a thorough manner, an unusually large factor of safety being employed. The armature is drum-wound with formed coils. It is built substantially, and the utmost care has been exercised in obtaining the greatest capacity from the space occupied.

By a novel arrangement of gears the circular motion of the motor is transformed, without complicated arrangement, into the straight-line motion of the primary or air-compressing piston located in a cylinder at the forward part of the machine. In the same cylinder is a second piston connected with the striking pick but having no mechanical connection with the first. Under the influence of the air which is compressed by the first piston and delivered through the open ports controlled by the same piston, the second piston is alternately driven backward and forward but always prevented by the air cushion from pounding at either end of the stroke. As the maximum amount of power is required only when the air is being compressed during the backward stroke of the motor-driven piston and during the control of the machine, that required by the electric motor is uniform, regardless of the character of the material in which the machine is working.

The piston diameter is six-and-one-quarter inches. A final pressure of about eighty pounds in the compressing cylinder has been found best for operation. At 220 volts the motor runs at three speeds, giving 170, 155 and 140 strokes per minute. The power input never exceeds seven-and-one-half horsepower—about one-third of that usually required by other types of machines.

In brief the operation of the machine is as follows:

The pinion B on the end of the armature shaft A engages with the main driving gear C. Through the medium of the internal gear F, the crank-pin E and the crosshead H, the rotating movement of the armature is changed into the reciprocating motion of the piston rod I and the piston J. The latter or rear piston, which is driven by the motor, compresses air on its backward stroke; the front piston K, with which it has no mechanical connection, follows simultaneously because of the vacuum produced by the recession of the piston J. Air is coincidently admitted to the front side of piston K through the port R. On the rear side of piston J, the next to the motor, the air is compressed and just at the end of the stroke is admitted through large by-passes to the space between the two pistons. As a result the front piston is forced forward by the entire body of compressed air which is admitted almost instantaneously. The speed is far higher and the resultant blow is much more powerful than in the ordinary compressed-air coal cutter, although the amount of air expanding behind the Pneumelectric system is very much less. During this stroke air is drawn into the cylinder behind the piston J, through the main inlet valve O. On its forward stroke the air in front of the driven piston K escapes through the port R, but after the piston has passed and therefore closed the port a sufficient amount of air remains to cushion the blow and prevent damage to the front cylinder head.

This cushion air may leak somewhat, and to prevent an insufficient supply remaining, which would have the effect of producing a partial vacuum in this space and holding the front piston on the return stroke, a small inlet valve R is placed in the forward part of the cylinder to allow air to flow in under these conditions and before the open port is passed.

After the front piston K has made its forward stroke the rear piston J follows, mechanically driven as before, and would compress the air which has just made the stroke of the front piston and the remainder between the two pistons but for the so-called vacuum valve S, which allows all air between the pistons above a certain pressure to escape to the atmosphere. The placing and action of this prevents the two piston faces coming together.

Steam Turbines for Many Industries.

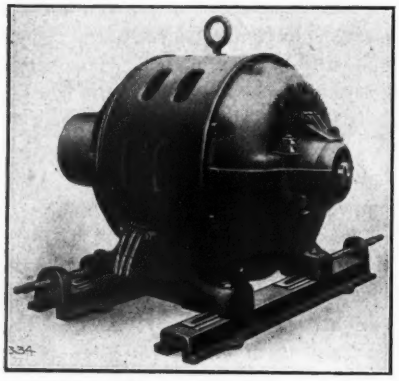
An interesting feature of the present business revival is the rapidly increasing demand for steam-turbine generating units of the new patented type built by the Allis-Chalmers Company, Milwaukee, Wis. These, although placed on the market less than three years ago, soon sprang into prominence and have now been carefully tried out in mills, factories, and industrial establishments representing all of the principal branches of manufacturing, as well as in central stations, traction power houses, mines, collieries, smelters, ore-reduction works, and plants of other kinds in considerable variety. Significant also is the fact that many of the orders now being placed call for a second, a third or a fourth unit, for extensions to be made to the power plants of those who have had the machines longest in service.

The Memphis Consolidated Gas and Electric Company, which put an Allis-Chalmers steam turbine and generator of 1,500 kilowatts capacity in operation some time ago, has contracted for two additional units with a combined output of 3,000 kilowatts; the Pacific Mills, of Lawrence, Mass., are installing a unit rated at 3,250 kilowatts to supplement three already in their plant; the Pfister & Vogel Leather Company, of Milwaukee, is completing a new power house in which will be placed two units of 1,500 kilowatts each; the Golden State Portland Cement Company, building new mills at Oro Grande, Cal., will equip them with a 750-kilowatt unit furnishing current for a large line of motors ranging in size up to 300 horsepower each, which are also of Allis-Chalmers Company's build; F. W. Bird & Son, paper manufacturers of East Walpole, Mass., have purchased a unit of 750 kilowatts capacity; the Clark Thread Company is arranging for shipment of the first unit of 2,000 kilowatts capacity to be placed in the large new power station built for its group of mills at Newark, N. J.; units of 1,500 kilowatts each are being installed by the Pepperell Manufacturing Company of Biddeford, Me.; and the Dan River Power and Manufacturing Company at Danville, Va., the Huron Portland Cement Company of Alpena, Mich., the Santee River Cypress Lumber Company of Ferguson, S. C., and a great many others have contracted for these machines.

The purchases recently made also include, in nearly every instance, auxiliary steam and electrical equipment, such as condensers, steam and motor-driven exciter sets, transformers, switchboards, motors, etc., making the aggregate of expenditures of steam-turbine users one sufficient to exert considerable influence upon the present industrial situation; for, while the apparatus mentioned is built in one set of shops, under one management, and its sale accrues principally to the benefit of one company, it necessarily involves large additional disbursements, of one kind or another, and puts a large amount of money in active circulation.

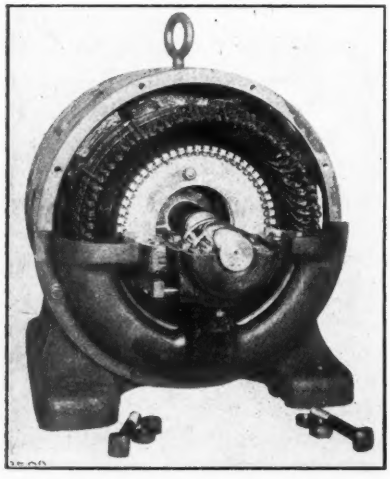
Polyphase Mill-Type Motors.

The conditions surrounding the application of electric motors in steel works are the most severe of any to which this form of drive is subjected. The advantages of electric motors, however, in such heavy service have been demonstrated, and if properly designed for the conditions, they give more satisfactory service for driving heavy mill work than any



WESTINGHOUSE POLYPHASE SQUIRREL-CAGE MOTOR FOR HEAVY MILL SERVICE.

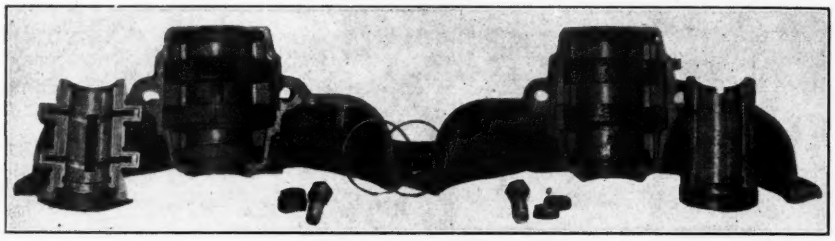
other form of power. Direct-current motors were first used, and their success has caused a demand for suitable alternating-current motors capable of standing the hardest knocks. To meet this demand, the Westinghouse Electric and Manufacturing Company has developed a



WESTINGHOUSE POLYPHASE MILL MOTOR, UPPER HALF OF BEARING REMOVED TO SHOW ACCESSIBILITY.

line of polyphase induction motors of the squirrel-cage type. These type M S motors are made in standard sizes, from five to seventy-five horsepower, for use on three-phase, twenty-five-cycle circuits of 220 and 440 volts.

The squirrel-cage induction motor has the advantage that the absence of all sliding contacts makes possible the construction of an almost indestructible machine. As shown by the accompanying illustrations, these motors are characterized by rigid construction, the parts being proportioned to meet the most severe stresses. The frame and bearing brackets are formed so as to give complete protection to the inner parts, while permitting good ventilation.



PARTS OF BEARING BRACKET OF WESTINGHOUSE POLYPHASE MILL MOTOR, WITH BEARING SHELLS REMOVED FROM HOUSING.

The stator frame is a cylindrical iron casting, with large solid supporting feet. The stator winding consists of form-wound coils of heavy copper wire or strap thoroughly insulated and laid in open core slots. The ends of the coils are corded to a heavy iron ring that holds them rigidly in place and prevents all vibration. The bearing brackets are heavy castings, with machined rings to fit the ends of the frame. Each bracket is held by eight bolts, and can be readily turned through ninety or 180 degrees for wall or ceiling mounting. Four substantial arms support each bearing housing, which is cast solid with the bracket. The bracket is slit in a horizontal plane, to permit removal of the upper half without disturbing the lower portion. This gives ready access to the interior parts.

In the rotor core, the laminations are clamped between stiff end plates on a cast-iron spider, to which they are securely keyed. The rotor cores have a minimum possible diameter and are comparatively long in the axial direction, so as to reduce the radius of gyration, and thus make the motor better adapted for reversing service. The rotor windings are insulated copper bars in partially closed slots, the ends being bolted to heavy copper end rings, with a large ventilating surface. In operation the ventilation is secured by the air entering the opening in the bearing brackets and passing partly through the spider and the ducts in the rotor and stator cores and partly between and around the end rings, cooling them, and the ends of the windings on the rotor and stator. This arrangement permits of very rapid heat dissipation.

Since the bearings are the only wearing parts of a squirrel-cage motor, special care has been taken to make them capable of maximum service. They are large and rigidly supported in the housings; the bearing shells are of cast-iron, split and lined with babbitt; each bearing shell has three machined bosses that rest on seats in the housings. Lugs and shoulders cast on the shell and housing prevent the bearing from turning or shifting, thus rigid and perfect alignment are insured under all conditions, and repairs, if necessary, are easily made. The bearings are self-oiling, each being provided with two oil rings.

In the design of Westinghouse induction-type mill motors, the slip has been made such that the starting torque is very high, without requiring excessive starting current. This makes these motors especially adaptable to the severe starting conditions always found with heavy machinery, and their high pull-out torque makes them serviceable where subjected to heavy temporary overloads.

AUTO-STARTER FOR POLYPHASE MILL MOTORS, WITH OIL TANK LOWERED.

These motors are designed for use with auto-starters of type E for starting purposes. These starters are self-contained in a cast-iron case, the auto-transformers being mounted in the upper portion

thereof, which also contains the switch mechanism. The lower part of the case forms the oil tank, in which the switch contacts are immersed. The handle of the starter can be thrown into three positions: off, starting and running. A locking device holds the lever securely in the off and in the running positions until released by pressing the thumb-piece at the end of the handle. The handle does not remain in the starting position unless held by the operator, and on being released it returns at once to the off position. A mechanical device prevents moving the handle directly from the off position to the starting position without first pausing at the starting position. Each auto-transformer is provided with three intermediate taps, either one of which can be selected for the starting, and by means of which the starting voltage can be made fifty, sixty-five or eighty per cent of the line voltage.

Where a number of these motors are operated in the same vicinity, it is possible to secure some economy by installing one auto-transformer for the whole group and using a separately mounted auto-starter switch for each one.

The "New Wrinkle" Pull Socket.

The Bryant Electric Company, Bridgeport, Conn., has placed on the market the "New Wrinkle" pull socket, illustrations of which are shown herewith. The construction of this new pull socket permits it being quickly and securely installed in the husk and allows the pull chain to be located at any desired point in the husk. The chain guide is mounted on a socket mechanism, instead of on the shell. It is possible to install the sockets without removing the chain.

EXPLODED VIEW OF BRYANT "NEW WRINKLE" SOCKET.

BRYANT "NEW WRINKLE" SOCKET.

The switching mechanism is quick-make and quick-break, and there is a screw for regulating the tension of the spring which draws back the chain which is easily accessible.

Lang Universal Service Cabinets.

In response to a demand for a panel-board which will do away with the necessity of two separate cabinets, reduce the number of connections, and simplify the installation, the J. Lang Electric Company, 117 North Lincoln Street, Chicago, has placed on the market the "Universal" service cabinet, combining a panel and a cabinet, with a main switch, main fuse, meter loop and panel-board in one.

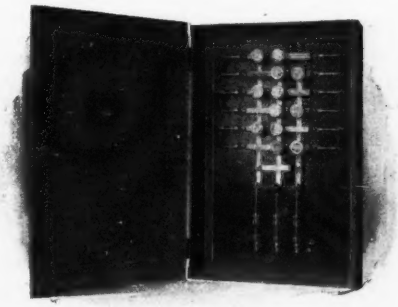


FIG. 1.—STYLE SG SERVICE CABINET.

It can be used on a two-wire, 110-volt system, or a three-wire, 250-125-volt system; means for converting from one system to the other are provided on every panel. This change can be made in a moment's time.

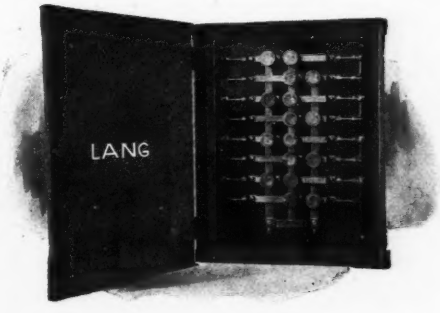


FIG. 2.—STYLE TG SERVICE CABINET.

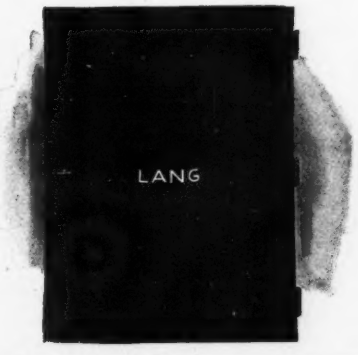


FIG. 3.—LANG STEEL SERVICE AND CUT-OUT BOX.

Fig. 1 shows a style SG service cabinet which is a Lang "Universal" panel-board with switches in the branches, New Code fused switch and meter loop in mains, enclosed in steel cabinet.

Fig. 2 shows a style TG service cabinet which is a Lang "Universal" panel-board with switches in branches and terminals only in mains.

Each steel cabinet is furnished with three knockouts for one-half-inch conduit in each end and knockouts for one-half-inch conduit along the sides, five-eighths of an inch apart. These cabinets are made of No. 16 steel and heavily painted with P. & B. compound.

Fig. 3 shows the Lang steel service and cut-out box. These boxes are constructed of No. 16 sheet steel. The tub is made of one piece, formed up and riveted. There are three knockouts in each end for one-half-inch conduit and knockouts along the sides for one-half-inch conduit, spaced five-eighths of an inch apart.

The doors are made of one piece of sheet steel, slightly dished for reinforcement purposes; the edges are turned in so that when they are closed, the box is practically dust and water-tight. They are covered with two coats of P. & B. paint.

They are made in two depths, three-and-one-half and five inches, and will accommodate any style of Edison cut-out, combination switch and cut-out, fuse block, centre of distribution, Lang "Universal" panel-board or "Universal" panel-board units.

A "Wireless" Therapeutic Battery.

Probably including the only really novel improvement in simplifying the design of a therapeutic faradic battery since the portable coil outfit became popular, the Wizard pocket battery, the invention of George W. Goss, M. D., demonstrated at the Chicago Electrical Show its simplicity and freedom from connecting cords, binding posts and other complications.

Enclosed between two metal electrode plates, separated by rubber insulation, are mounted the special dry cell and induction coil. A button at one side, moving in a slot, controls the movement of the graduating shield, serving to start the operation of the coil and varying the secondary current to any required degree. The working parts are thus enclosed and protected, and the sides of the case form the delivery electrodes. Attachments arranged to fit over the side plates carry hair-brush and pad electrodes. All metal parts are handsomely nickeled, the insulating sections are of polished black rubber and the whole outfit is contained in a snug case.

Assistant Physicist.

The United States Civil Service Commission announces an examination on April 21, 1909, at the usual examining places, to secure eligibles from which to fill ten or more vacancies in the positions of laboratory assistant (in physics) and assistant physicist in the Bureau of Standards, at salaries varying from $900 to $1,200 per annum for laboratory assistant, and from $1,400 to $1,800 per annum for assistant physicist, and vacancies requiring similar qualifications as they may occur.

The duties in connection with these positions are similar to those of assistants in the physical laboratories of scientific and technical institutions. As far as practicable, appointees are assigned to work in the subjects for which they are best fitted.

The examination will consist of the subjects mentioned and weighted as follows: (1) General physics, twenty-five per cent; (2) special subjects: (a) Advanced general physics, (b) theoretical and experimental electricity, twenty-five per cent; (3) education and experience (rated on application), fifty per cent. Two days may be required for this examination.

Applicants must indicate the special subject in which they desire to be examined. They must show in their applications that they have been graduated or are about to be graduated from colleges or technical schools, or that they have attained an equivalent education or training. The age limit is twenty to thirty-five years on the date of the examination. Applicants should apply at once to the United States Civil Service Commission, Washington, D. C., for application form 1312. No application will be accepted unless properly executed and filed, in complete form, with the Commission at Washington on or before April 10, 1909.

Gas-Engine Installations.

The Salisbury Steel and Iron Company, Herkimer County, N. Y., is installing a new plant with anthracite producers to operate the mill and the mine shafts in the vicinity. The initial equipment will comprise a 600-horsepower horizontal and a 125-horsepower vertical engine, both driving generators which operate at a frequency of sixty cycles. The power house will be located a few hundred feet from the mill, and the shafts about one mile distant. The plant will also furnish electric power for compressed-air and hoisting service to the mines and for concentrating machinery at the mill.

An interesting feature at this station was the competition offered by a water-power plant located but six miles distant. Although offering current at a very low rate, it was considered possible to produce power at a still lower figure by a producer-gas station. The Salisbury mines produce a high grade of magnetic iron ore.

The Standard Underground Cable Company is constructing a new mill at Perth Amboy, N. J., and will install a 750-horsepower horizontal producer-gas electric unit to furnish electric power to the new wire mill. Gas will be furnished from a plant of Westinghouse anthracite suction producers yielding gas of about 120 British thermal units per cubic foot. A certain portion of the producer gas will also be used for heating and annealing operations in the wire mill. This engine will be the first of a new size developed at East Pittsburg suitable for direct connection to a 500-kilowatt generator with reasonable overload capacity. The engine and generator will be solid-coupled, operating at a frequency of sixty cycles.

Copper and the Depression in Metal Prices.

The following abstract is taken from an article in the Cincinnati *Enquirer*, entitled "The Depression of Metal Prices:"

"The law of supply and demand was never more visible in its resistless action than at the present time upon nearly all classes of metals.

"Modern schemes of manipulation have virtually nullified or rendered impotent all laws save this, which, like Nemesis, never fails to exact retribution.

"When copper rose to the extraordinary prices of two years ago it was but a plain and direct violation of this first and highest of all economical laws.

"It was through bold manipulation and artificial methods, in direct defiance of all rules of business safety, that the high range of values was reached, and today the world-wide depression of the copper trade is to a great degree the result of the work of bold and selfish operators who were then in temporary control.

"Copper, in three great movements during the past forty years, has brought ruin and disaster to those who knowingly led, and many who unwittingly followed them, into reckless disregard of the most powerful law of commerce. With an admitted surplus of 173,000,000 pounds of copper metal on the market today, and a suspected surplus of double that amount, it can be seen how dangerous and far-reaching was the policy which placed high prices as a premium for even greater production."

The National Electric Light Association Convention.

Plans are being completed for an excellent programme for the convention of the National Electric Light Association, which will be held at Atlantic City, N. J., June 1, 2, 3 and 4. The Trunk Line Passenger Association has authorized a rate of a fare-and-three-fifths for a round trip on the certificate plan.

The exhibition committee, with Frank H. Gale as chairman, is completing plans for exhibits by the class D members. The exhibition will be held on the million-dollar pier, directly facing the boardwalk. The booths will each have a frontage of nine feet and a depth of fifteen feet, and will be arranged in the shape of a horseshoe.

Electric Switch Invention.

Consul Jerome A. Quay, of Florence, Italy, writes that Dante Bechi and Galileo Serafini, two mechanics, have lately invented a useful apparatus for use on electric tram cars by means of which rail switches may be shifted to any point desired without stopping the car.

This electromechanical switch consists of a box containing an electrical apparatus hermetically closed, from which two wires start and are connected with an upper contact. Inside the trolley there are two invisible contacts, which, through two wires, lead to two communicators placed on the platform. The switch needle, under the manipulation of the driver, is brought in contact with the trolley wire some ten or fifteen yards before reaching the switch, and the course of the car is turned to the right or the left, as desired, without stopping the car.

New York Electrical Society at the Hippodrome.

On Wednesday evening, March 31, the New York Electrical Society will attend the performance at the Hippodrome, and after the spectacle, will assemble on the stage, when an address will be made by Arthur Williams, describing the electrical equipment. A unique opportunity will be thus afforded of becoming familiar with the most modernly equipped of American playhouses.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, MARCH 12.—The decision of the Comptroller of General Patents in revoking the Bremer flame-arc patents, owned by the Westinghouse Company, has been appealed against to the high courts and the case was considered this week. The action has revealed, if not some flaws in the new Patent Act, at any rate, considerable unfairness. In the first case the judge is obviously impressed with the feeling that if, as is stated, the intention of the Legislature was to bring manufactures into Great Britain, the revocation of this patent, or, indeed, any others under similar circumstances, will have the opposite effect, inasmuch as the patent not being in existence any number of infringing lamps may be imported. The procedure before the Comptroller of Patents under the new Act is also found considerable fault with. Any person may lodge an application alleging that a patent is not being sufficiently worked in this country, but need give no evidence on the point. The comptroller is thereupon empowered to call upon the patentee to produce evidence to prove one way or the other. In this way a trade rival may obtain access to the books of another, and, indeed, one of the leading patent lawyers here has publicly asserted that this is being done under cover of the Act. The Comptroller himself has confessed that this is distinctly unfair to the patentee, and it is obvious from the remarks of the judge that there will be a change.

The London County Council is keeping a sharp eye just now upon the spending capabilities of the Borough Councils and where possible is doing its best to check it. For instance, the Marylebone Borough Council wished to borrow $40,000 for converting some 2,000 street incandescent gas lamps into electric lamps, notwithstanding the fact that about five years ago $55,000 were spent in transforming the same lamps from flat-flame gas burners into incandescent gas. As the County Council regards the saving to be made of a somewhat problematical order, it has refused to sanction the loan.

Messrs. Willans & Robinson, makers of the well-known high-speed reciprocating engines and more recently of steam turbines, are now taking up the manufacture of water turbines.

The Association of Chambers of Commerce have now reported that, whereas the Postmaster-General has expressed his willingness to meet them in regard to doing away with the new message-rate system of charging, the National Telephone Company is not, and that, therefore, the whole matter must remain over until the telephone system of the country is in the hands of the government. With regard to the checking of capital expenditure during the remaining years of the Telephone company's lease, negotiations are now proceeding between the company and the Postmaster-General to arrange for the continuance of the policy hitherto in order to avoid discharging numbers of employes. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, MARCH 13—Paris is connected by telephone lines with Berlin, Milan and London, and conversation can be carried on with these cities. While it is possible to telephone from points outside the city in the suburbs, to Madrid or Vienna, which are farther off, this cannot be done from the Gutenberg central exchange, lying in the centre of town, and even with Rome it is hard to have a good conversation. The reason for this has been brought out by a prominent telephone engineer, M. Devaux-Charbonnel, connected with the Paris Telephone Department. He shows that the underground cables, which are laid in the sewers, and also the branch lines to the subscribers, are the cause of the difficulty. His calculations show that if we allow six miles of underground lines lying between the fortifications and the Central Exchange, and the same length of wire for the subscribers' lines, the result in cutting down the telephone efficiency is the same as if we increased the main overhead line, starting from Paris, by nearly 400 miles.

Work has been commenced on the telegraph line which is to cross the Sahara in order to connect Algeria with the other French colonies lying farther south, and, in the western part of Africa, in the region of the Niger and at Timbuctoo. Hollow steel poles are used in this case, and the cost of the undertaking is figured at $400,000.

The Italian railroad administration is taking measures to apply electric traction on a number of sections of standard-gauge road, and the construction work will be commenced at an early date. About $7,000,000 has been set apart for this purpose.

A number of scientists in France are engaged in researches upon the sterilizing power of the rays from the mercury-vapor lamp when contained in a quartz receptacle. It is found that when such a lamp is immersed in water the action of the rays will destroy the microbes all around the lamp and within a certain distance. The process will no doubt have a great practical value for purifying water. Professor Dastre and M. Henri, of the Sorbonne, are engaged in this work, also M. Billon-Daguerre and others.

A new central station is to be erected at Giesendam, Holland, and it is probable that it will also give a supply for the town of Dordrecht, which lies near by. At Meezenley-Innien, Germany, the contract is soon to be awarded for an electric plant. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, MARCH 20.—It has been given out at the local offices of the Marconi Wireless Telegraph Company that there will probably be a wireless service between Montreal and Quebec during the coming navigation season of the St. Lawrence.

Another big power corporation seeks authority from the Quebec Legislature to plant poles, string wires, lay pipes and other apparatus in the streets of Montreal without the necessity of asking the city for the privilege. This bill is presented on behalf of the Saraquay Electric and Water Company, which has a charter allowing it to do business on the island of Montreal and in adjacent counties.

Another telegraph and telephone company will soon be ready for business. As soon as the frost is out of the ground, the Northern Commercial Telegraph Company will commence construction of its line between Point Levis, Que., and Windsor, Ont. A contract for 1,000 miles of lines has just been awarded. This new company is being financed largely by American capitalists.

The latest developments in the Mexican Light and Power situation is a report from a reliable source that the present controlling interests of the company will not maintain its common stock dividend on a six-per-cent basis. It is understood that the old rate of one per cent will be declared for the current quarter. While the one-and-one-half-per-cent quarterly, declared by the last board of directors, was not a definite announcement of a six-per-cent-annual rate, it was generally believed that such rate would, in future, be maintained, and there is little doubt that the old board would have continued the higher rate had it not been succeeded by the Sperling-Pearson interests. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, MARCH 20.—Sealed tenders will be received by Magnus Peterson, secretary of the Civic Board of Control, Winnipeg, Man., until April 2 for the supply of insulators, top pins, etc., for extensions to the civic lighting system. Specifications and all details may be obtained from F. E. Cambridge, city electrician.

The British Columbia Electric Street Railway Company has applied to the City Council at Victoria, B. C., for a franchise to supply electric light and power in that city. The company proposes to build a power plant on the Jordan River at a cost of $1,500,000. They ask for exclusive privileges. R. H. Sperling, Vancouver, B. C., is general manager of the company.

The municipal electric-lighting plant at Kamloops, B. C., will be equipped throughout with new machinery, tenders for which will be called shortly.

At Wascana, Sask., the Wascana Rural Telephone Company has been incorporated and the Tregarva Union Rural Telephone Company, with head office at Tregarva, Sask. Both will start construction work almost immediately.

Sealed tenders will be received by Nap Tessier, secretary of the department of public works, Ottawa, Ont., until 4:30 p. m., March 30, for the supply of the fixtures and the electrical wiring in connection with the new public building at Selkirk, Man.

Recent legislation provides that it is an indictable offense for any Canadian vessel of 400 tonnage or over going to sea without wireless telegraph equipment. The penalty is from $100 to $1,000 for each offense.

A rural telephone company is being organized at Manor,

Sask., and construction work will be started in the spring. Address W. G. Bell, Manor, Sask.

The farmers in the vicinity of Bienfait, Sask., are completing the organization of a rural telephone company. Address Ira F. Brown, Bienfait, Sask.

The farmers of Paipoonge Township, New Ontario, are organizing to secure a telephone system with connections to Port Arthur and Fort William. Address Dr. D. C. Garver. R.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

MEXICAN POWER AND IRRIGATION DEVELOPMENT—It is announced in Mexico City that the financing of the Mexican Agricultural and Electrical Power Company has been completed, a syndicate of French bankers and capitalists having become interested in the project. About $10,000,000 will be expended in the initiation of the hydro-electric plant, which will be situated on the Conchos River near Santa Rosalia. Some of the power will be used to operate pumps for irrigating 150,000 acres of land which the company has purchased.

SOUTHERN PACIFIC ELECTRIFICATION—Coincident with the resumption of work on the electrification of the Alameda lines of the Southern Pacific Railroad near San Francisco, the terms of the contracts for the equipment of the electric power station at Fruitvale and for the motor cars have been made public. The total expenditures called for amount to $748,960. The General Electric Company will furnish forty-four multiple-unit, four-motor cars for $374,960. Among the power-house contracts is one with the Westinghouse Machine Company for two 5,000-kilowatt turbo-generators for $190,000.

ALTOONA EDISON COMPANY TO ENLARGE PLANT—At a meeting of the directors of the Edison Electric Illuminating Company of Altoona, Pa., it was decided to enlarge and rebuild the plant and increase its capacity and the territory served. Contracts will be closed immediately with the General Electric Company and the Westinghouse Company for dynamos, electrical machinery and supplies, and with other manufacturers for new boilers and engines. The estimated cost of these additions to the plant is in the neighborhood of $250,000. Financial arrangements have been completed with the American Gas and Electric Company by which the latter company agrees to furnish the Altoona Edison Company the money as it is needed.

KLAMATH RIVER PROJECT—Claims have been filed by the Siskiyou Electric Power and Light Company, Yreka, Cal., through its president, Jesse W. Churchill, and secretary, Alex J. Rosborough, for 450,000 inches, measured under a four-inch pressure, of the waters of the Klamath River. The water will be deflected at two points, about a half-mile from the present power plant on Fall Creek, and the entire flow of the river at low water will be carried by this water location. Early this spring construction work is to begin on the company's new power plant at Ward's Canyon on the Klamath River. Machinery capable of developing 60,000 horsepower is to be installed here. The plant at Fall Creek is developing about 6,000 horsepower, which is now insufficient to meet the demands upon it. A.

ENLARGEMENT OF DETROIT PLANT—The Detroit Edison Illuminating Company has resumed work upon its enlargement of the Delray power plant. The plant now contains five 3,000-kilowatt turbo-generators and cost originally more than $2,000,000. About two years ago plans for enlargement were drawn up and the foundations for the addition had already been laid, when it was deemed advisible on account of the financial conditions to postpone further work. The work on the addition now being resumed calls for the installation of two turbo-generators of 14,000-kilowatt capacity each, so that the company, by putting off the work, has been enabled to avail itself of the advance in turbo-generator design as well as to save considerable in the cost of these additions. Its cost is estimated at $1,250,000, which is very much less than it had been contemplated to expend for the additional equipment.

LIGHTING AND POWER

(Special Correspondence.)

MOORE, MONT.—Geo. I. Fogle is planning the erection of an electric-light and power plant.

CALIFORNIA, MO.—This city has voted a franchise to S. W. Carver for an electric-light plant.

HEBER, ARK.—The Heber Light and Power Company has been incorporated with a capital of $10,000.

SENTINEL, OKLA.—Jennings, Barrett & Company have a franchise for an electric-light and power plant.

LAS ANIMAS, COLO.—The Las Animas Electric Company has been incorporated with a capital of $25,000.

WILLIAMSTOWN, N. J.—Williamstown taxpayers are talking of erecting a water and an electric-light plant.

BOULDER, COLO.—The Rocky Mountain Hydro-Electric Company will erect a power plant soon, to cost $1,000,000.

SALT LAKE CITY, UTAH—The franchise of the Salt Lake Public Service Company has been extended in this county till January 1, 1910.

UPTON, MASS.—At a recent town meeting it was voted to light the community by electricity. A three-year contract was made with the local company.

ST. PETER, MINN.—The municipal electric-light line will be extended to Kasota, thirty business houses and residences having agreed to install electric lights. C.

SEATTLE, WASH.—The Ranier Power and Irrigation Company has been incorporated here with a capital stock of $100,000 by Frank Mackean, J. J. Wilson and others. A.

SPOKANE, WASH.—The Spokane-Orient Power Company has been incorporated here with a capital stock of $1,000,000 by C. A. Lunceford, C. H. Patten and A. R. Patten. A.

SEATTLE, WASH.—The Nesqualem Smelting and Power Company has been incorporated here with a capital stock of $500,000 by William Kingsley, J. J. Frantz and others. A.

SAN BERNARDINO, CAL.—The Needles Light and Power Company has been incorporated here with a capital stock of $50,000 by W. B. Palmer, W. W. Perry and M. P. Thue. A.

XENIA, OHIO—The city has closed a contract with the Citizens' Light and Power Company to light the streets for a period of ten years. The company's $10,000 bond was accepted.

LOS ANGELES, CAL.—A resolution has been passed by the City Council authorizing the Board of Public Works to advertise for bids for ornamental lights on certain streets of this city.

TACOMA, WASH.—John F. Mead, city controller of Tacoma, will receive bids until April 5, for $300,000, not exceeding five-per-cent semi-annual, twenty-year electric-light and power system bonds.

LEAD, S. D.—The Homestake Mining Company will expend $500,000 on the installation of a new power plant at Spearfish Creek. A conduit of three or four miles in length will be installed. C.

TOLEDO, OHIO—The general offices of the Lake Shore Electric will be removed from Norwalk to Sandusky, O. All the details have been arranged and the move will be made on April 1. H.

SPOKANE, WASH.—The Washington Water Power Company is to build another 60,000-volt high-tension power line from its substation at Twenty-ninth Street to the new power station at Little Falls. A.

SALEM, IND.—The Town Board is asking for bids for the improvement of the local waterworks system, including the installations, two gasoline engines, pumps and other equipment. Frank Munkelt is president.

DE FUNIAK SPRINGS, FLA.—The City Council of De Funiak Springs, Fla., is considering an appropriation of $12,000 for the construction of a municipal electric-light plant, which is expected to be built in the near future.

LEAVENWORTH, KAN.—The Leavenworth Light, Heat and Power Company, which also lights Fort Leavenworth, will install about 70,000 duct feet of underground conduit this summer. W. H. Fellows is superintendent.

EGG HARBOR CITY, N. J.—The Enterprise Gas Company has, through an intermediate company, bought out the Atlantic County Electric Company, thus securing a monopoly of the city's light supply. The price paid was $22,000.

LEWISBURG, PA.—Lewisburg will be electrically lighted if sufficient power can be developed from Buffalo Creek. An option has been taken on the Shriner mill property and an engineer will be engaged to determine the practicability of the project.

MOKENA, ILL.—A number of Tinley Park residents have clubbed together and organized an electric-light plant. All that are interested in this concern are home people. The estimated cost of the plant is $3,000. Building operations are to commence shortly.

RED LAKE FALLS, MINN.—A five-year franchise has been granted to the Red Lake Falls Electric Light Company. By the terms of the ordinance the city must take eight or ten (as the Council may order) 1,200-candlepower arc lights at $90 per annum for each light. C.

HAZLETON, PA.—The Harwood Electric Light and Power Company has contracted to furnish current for the recently organized Columbia Power, Light and Railway Company, which is a consolidation of several light and trolley companies in Columbia and Montour counties.

JOHNSTOWN, PA.—The Consumers' Gas Company and the Johnstown Fuel Supply Company have been absorbed by the Citizens' Light, Heat and Power Company. Cash and stock in the new company were paid for the two old companies. The capital of the new concern is $2,692,000.

NEW BRITAIN, CONN.—The board of public works has practically decided to renew the street-lighting contract with the Connecticut Company at the old rate of $85 per arc lamp per year. The contract will run for three years with the privilege of extending to five. No lower figures were submitted.

TOLEDO, OHIO—Franchises have been asked for at Muncie and New Castle, Ind., for the construction of an electric line to connect the two points. W. L. David and L. S. Nichols of Findlay, Ohio, are the promoters of the new line and it is said that the rights will be granted and work begun the coming summer.

KNIGHTSTOWN, IND.—The City Council has employed a consulting engineer to examine the municipal lighting plant and suggest the needed improvements and electric equipment necessary to put the plant in good condition again. The plant has been out of repair and the service very unsatisfactory for the past six months.

OROVILLE, CAL.—H. O. Lague has appropriated 25,000 inches of water of the Middle and North Forks on Nelson Creek, in Plumas County. An agreement has been made with S. B. Crane and E. Talbot, of Reno, Nev., whereby Mr. Lague is to sell water for generating electricity at $2.50 for every horsepower generated. A.

ALBANY, N. Y.—The Syracuse Lighting Company has applied to the upstate Public Service Commission for authority to issue a mortgage for $2,500,000 and consent to issue $207,000 first extension and improvements six-per-cent, ten-year bonds under such mortgage. Proceeds of these bonds are for extension to the distributing system of the company.

BOONSBORO, MD.—The Antietam Electric Light and Power Company has been incorporated with a capital of $18,000. The directors are C. E. Easterday, O. E. Shiffler and H. L. Moser. The company already operates a power house on the Antietam at Delemore Mills and furnishes current to Boonsboro. The lines will be extended to Keedysville.

BODIE, CAL.—Two electric power plants are to be built here this spring, one on Rush Creek and the other on Leevining Creek. Each plant will have a capacity of 15,000 horsepower and will be able to supply the entire country within a radius of 100 miles. A number of the mining companies have contracted for power, begining this summer. A.

SOUTH BEND, IND.—Rivalry among the local merchants in locating and erecting electric arches for advertising displays is enabling the electric-light company to reap a harvest. Eleven arches have been erected and more are contracted for. When all these arches and displays are completed and operated South Bend will be the best lighted city in the country.

WAGNER, SO. DAK.—The Dakota Gas, Electric Light and Power Company, Wagner, So. Dak., has purchased from the Minneapolis Steel and Machinery Company an eighty-horsepower Muenzel producer-gas engine and suction gas-producer plant. This outfit will be installed in the electric-light plant at Wagner, where there is already one Muenzel unit in operation.

REDLANDS, CAL.—An agreement has been made between the Edison Electric Company and the Home Gas and Electric Company, whereby but one gas and one electric company will exist in this city hereafter. The Edison Electric Company takes over the electric business of this city and the Home Gas and Electric Company takes over the gas plant and gas business here.

ACTOPAN, STATE OF HIDALGO, MEXICO—A concession has been granted to D. Andres Omana for the installation of a hydroelectric plant on the Actopan River to furnish electricity to light the town of Actopan. The power will also be used to operate a rice-cleaning plant. Under the concession he is granted the right to take 1,000 liters of water per second from the Actopan River. D.

SAN FRANCISCO, CAL.—Permission has been granted the Nevada-California Power Company by the United States Department of Forestry, to construct a second transmission line through Silver Canyon, in the White Mountains, Nevada, with the stipulation that the company make any changes which shall be necessary to allow the Owens River Water and Power Company to operate a line through Silver Canyon. A.

HUSUM, WASH.—The dynamo is being placed in the electric-light plant of the Husum Power Company, and workmen are engaged in establishing a line from this point to White Salmon, which will give that city a lighting system. The power plant is rapidly nearing completion, and the power derived therefrom will be used by the ranchers up and down the White Salmon Valley for manufacturing and lighting purposes.

JOSEPH, ORE.—The Wallowa Lake Light and Power Company has been incorporated here with a capital stock of $15,000 by J. H. Dobbin, Aaron Wade, L. H. Caviness, L. Knapper and Albert Hursweiler. A power site has been secured near the lake where a 147-foot fall is secured, which is capable of developing 3,000 horsepower. A thirty-year franchise has been granted the company to supply Joseph, Enterprise and other towns with electric power. A.

LESTERSHIRE, N. Y.—Many taxpayers of this city are expressing the belief that the $13,000 estimate for the proposed municipal electric-light plant is far below its actual cost and have, therefore, retained an electrical engineer to go over the project carefully before it is voted on. The bonded indebtedness of the village is already over $99,000, so that if the revised estimate proves too high the plan will doubtless be voted down.

RED BLUFF, CAL.—Two claims have been filed this week for 10,000 inches of water to be taken from Mill Creek. A. T. Forward asked for the right to divert water from the north bank of the stream to a site where he will locate an electric power plant, and C. E. Burris asked for the right to obtain water from the right bank and carry it by a flume seven feet wide and four feet deep to a point where he is to install an electric power plant. A.

GUADALAJARA, MEXICO—It is reported that the Compania de Tranvias, Luz y Fuerza, of which Fernando Pimental is president, will acquire a concession from the City of Guadalajara for the establishment of a light and power system to compete with the system which Manuel Cuesta will install. Mr. Cuesta will furnish power to the city from hydroelectric plants on the Santiago River, which are to be installed principally to pump water from Lake Chapala for irrigation purposes. D.

SOUTH PASADENA, CAL.—The business district of South Pasadena will be lighted with a system of ten arc lamps as soon as the necessary changes can be made. A five-year contract covering the lighting for the city has been made with the Pacific Light and Power Company by the Board of City Trustees at a price of 7 cents per kilowatt hour. The new arc lights will be suspended from the centre of the streets. It is estimated that the additional cost of the arc lights to the city will be about $50 per month.

FARGO, N. D.—The Fargo Transmission Company has just been organized to build a steel tower transmission line between Fergus Falls, Minn., and Fargo, N. D. The figures are sixty miles, 66,000 volts, 3,000 horsepower. Edward P. Burch, the well-known electrical engineer of Minneapolis, has been chosen to act as consulting engineer for the company. The waterpower plant for this transmission line has already been completed and the transmission company has been organized to transmit the power. The capital stock of the company is $100,000.

GLENWOOD SPRINGS, COLO.—The Mutual Light, Heat and Power Company has been incorporated to supply power, light and heat. The company is backed by those who are said to be in favor of municipal lighting plants. The directors for the first year are: H. J. Holmes, G. W. Palmer, Carl Hedrick, John L. Noonan and C. E. Hubbard. The company asked permission from the county commissioners to use the county roads for its poles and wires. The company will also apply to Glenwood Springs for the privilege of supplying the city with light.

SAN FRANCISCO, CAL.—The demurrer filed by a minority of the stockholders of the Stanislaus Electric Power Company, the Stanislaus Electric Railway Company, the Tuolumne Water and Power Company and the United Construction Company, against the suit instituted by the Knickerbocker Trust Company, of New York, was overuled this week by Judge Morrow in the United States Circuit Court. By this decision all obstruction to the foreclosure proceedings have been wiped away and the companies can proceed to improve their plants and carry out the proposed plans whereby the United Railroads will be supplied with power. A.

FREDERICKSBURG, VA.—The Electric Generating Company of Fredericksburg has been organized by the election of the following officers: E. J. Smith, president; Isaac Hirsh, vice-president; Judge Alvin T. Embrey, secretary and treasurer; the above, with A. W. Embrey and A. P. Rowe, constituting the board of directors. The Fredericksburg Electric Company was organized by the election of the following officers: R M. Van Dorn, president; C. W. Jones, vice-president; Judge Alvin T. Embrey, secretary and treasurer. The above, with W. H. Poden and A. W. Embrey, constitute the board of directors. Each company has applied for a franchise.

SHERIDAN, WYO.—This city has granted to the Tongue River Electric Power and Transmission Company by unanimous vote of the City Council a fifty-year franchise for the sale of electric energy and gas. Large mining corporations operating coal mines in this vicinity are signing contracts to take all their power requirements from a large central station, the construction of which the company will undertake immediately. Plans and specifications for the power plant are being drawn up by the firm of Vail, Walbren & Read, electrical engineers of Denver, and it is now planned to have distribution of electricity commenced not later than December 1 of this year. Joseph J. Henry, largely interested in Colorado power companies, is at the head of the syndicate pushing the new project.

ELECTRIC RAILWAYS.

(Special Correspondence.)

DAVENPORT, IOWA—The People's Railway, Light and Power Company will expend about $250,000 on track improvements in the tri-cities. It will relay all old track that has not already been relaid. C.

PORT ARTHUR, TEX.—H. J. Myers and S. A. Price of Dayton, Ohio, representing a syndicate of capitalists, have been investigating the proposed street railway in Port Arthur, which will cost about $100,000.

NIAGARA FALLS, N. Y.—American and Canadian capitalists are contemplating the construction of a trolley line from Niagara Falls to Toronto. This would furnish a continuous traction line between Rochester and Toronto.

GRAND FORKS, N. D.—At a meeting of the board of directors of the Grand Forks, N. D., and East Grand Forks Street Railway Company, Edward P. Burch, consulting engineer, of Minneapolis, Minn., was authorized to proceed with the construction of six additional miles of track.

PITTSBURG, PA.—The Pittsburg Subway Company is said to have secured enough capital to build a $15,000,000 traction tunnel in the city as soon as it can get a franchise, and one of the first ordinances to be introduced after councils reorganize will be a new copy of the old subway bill.

CHICAGO, ILL.—A decree of foreclosure amounting to $33,419 has been entered in Milwaukee against the Chicago & Milwaukee Electric on property in Milwaukee County in favor of George Rockwell. The Rockwell lien is placed ahead of that of the Metropolitan Trust of Chicago, secured some time ago.

SHARON, PA.—Actual work of construction on the Cleveland & Sharon Street Railway will be started this spring. It is said that the promoters have succeeded in financing the road, and that the line from Sharon to Middlefield, O., will be built this summer to connect with the Cleveland & Eastern traction line.

EUREKA SPRINGS, ARK.—The Cassville & Western Railway Company has been organized at Eureka Springs for the purpose of developing a water power on White River to generate electricity for the company and for industrial purposes. It is intended to install a transmission line to convey the electricity to Cassville, Mo., Eureka Springs and other points.

SIOUX CITY, IOWA—Surveys for the Sioux City and Des Moines interurban road have been begun by the engineers of the Indianapolis Construction Company. It is believed that no grades exceeding one per cent will be met with, so that the initial and operating costs of the road will be comparatively low and the speed attainable close to sixty miles per hour.

BUSTLETON, PA.—The Bustleton & Byberry Street Railway Company has been organized and will operate cars between the upper end of Frankford to Byberry and Bustleton. This franchise was granted by councils, which repealed the ordinance granting this privilege to the Bustleton & Byberry Rapid Transit Street Railway Company, a Rapid Transit Company subsidiary, on March 13, 1906.

SOUTH BETHLEHEM, PA.—Work has been started on the completion of the South Bethlehem and Saucon trolley line, between Colesville and Centre Valley. The line between this place and Colesville has been completed and in operation for some time. The new line, via Lehigh Valley Transit connections, will cut off fifteen miles of the distance between Philadelphia and Delaware Water Gap.

TORREON, MEXICO—Work is to begin at once on the construction of the electric line short cut from Torreon to Lerdo, State of Durango, the concession for which was granted to the Ferrocarril Electrico de Lerdo a Terreon more than a year ago. The ties, trolley poles and wire have arrived and the steel will be on hand when the grading is completed. With the completion of this line a belt-line service will be maintained between Torreon, Gomez Palacio and Lerdo. D.

INDIANAPOLIS, IND.—Judge Carter of the Superior Court has ordered the Union Trust Company, receiver of the Indianapolis, Newcastle & Toledo Railway Company, to issue receiver's certificates for the completion of the electric line between Indianapolis and New Castle. The cost is limited to $450,000. The receiver will ask for bids as soon as the creditors enter their appearance. A great deal of work has been done on this road and the power house is well under way.

CHICAGO, ILL.—A bill for foreclosure of the mortgage guaranteeing the $2,000,000 bond issue of the old Cicero and Proviso Company has been filed in the county courts. At present the Cicero lines form part of the Consolidated Traction Company's system, which is being operated by the Chicago Railways Company. It is expected that this suit is but a forerunner of a series which will affect other underlying properties of the Consolidated system and which will result ultimately in a straightening of its affairs.

SYRACUSE, N. Y.—That considerable improvement will be made to the tracks and general equipment of the Rapid Transit system and a connection of the Syracuse & Suburban with the Rapid Transit lines established in the near future are assured as the result of a meeting of the directors of both companies held in New York last week. A considerable mileage of "T" rail will be installed and it is said that P.-A.-Y.-E. cars will be put on.

NEW YORK, N. Y.—The Bradley, Gaffney & Speers Company has made a proposition to the Public Service Commission to construct for the City of New York the Lexington Avenue Subway from a point in the Bronx to a junction with the bridge loop. It will equip, maintain and operate the same, the equipment to belong to the City of New York, the possession and right to operate to remain with the company until the cost shall have been fully paid with five per cent interest per annum.

HICKSVILLE, OHIO—Interest in the proposed trolley line from Bryan, Ohio, to Fort Wayne, by way of Hicksville and Maysville, has been revived by the incorporation at Columbus of the promoting company, Fort Wayne & Toledo Electric Railway Company, of Hicksville, Ohio. The capital stock is $100,000, and the incorporators named are: R. L. and C. L. Bastress, W. Behne, R. L. Starr and W. S. Thompson. The line would be a link between the electric roads centring at Fort Wayne, Ind., and the Toledo & Indiana, which runs from Toledo to Bryan. Connection with this line would give a direct route to Toledo from Fort Wayne.

LINCOLN, NEB.—A new interurban construction company has been incorporated with a capital stock of $200,000, of which $50,000 is paid up. The incorporators are E. F. Chessman, of Denver; Robert C. Druesedow, of Omaha; George P. Chessman, of York, and W. T. Morgan, of Denver. The company is backed by London capital and will offer no stock for sale. The new company is the Omaha & Lincoln Interurban Railroad Construction Company, and its headquarters will be in Lincoln. It is the intention of the incorporators to have their engineers in the field at once surveying a line between Omaha and Lincoln, following which they expect to start construction work.

LAKE CHARLES, LA.—The charter of the Lake Arthur, Jennings and Northern Railway Company, for which a special tax will be asked of the people of the Tenth Ward, has been filed with the district clerk. The first board of directors, as named in the charter, will be composed of W. B. Conover, George B. Zigler, B. B. Bliss, E. P. Fox, C. H. Fox and L. E. Bliss, of whom Mr. Conover is president; Mr. Zigler, vice-president and treasurer; B. B. Bliss, secretary, and E. P. Fox, general manager. The amount of capital stock is fixed at $1,000,000. The object of the corporation is stated in the charter to be the construction of a railroad from Lake Arthur, through Jennings, to some point on the Colorado Southern, New Orleans and Pacific Railway and the maintenance of same, the building of depots and terminals and the purchase of rolling stock.

NEW PROPOSALS.

POST OFFICE, KEARNEY, NEB.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m. on April 20 for the construction complete of the United States Post Office at Kearney, Neb., in accordance with the drawings and specification, copies of which may be had at the office of the Postmaster at Kearney, Neb., or from the Supervising Architect.

POST OFFICE, MANISTEE, MICH.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., April 21, for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Manistee, Mich., in accordance with drawings and specifications, copies of which may be obtained from the Supervising Architect.

POST OFFICE, WILLIMANTIC, CONN.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 p. m., April 22, for the construction (including plumbing, gas piping, heating apparatus, electric wiring and conduits) of the United States Post Office at Willimantic, Conn., in accordance with the drawings and specifications, copies of which may be had from the custodian of site at Willimantic, Conn., or from the Supervising Architect.

NEW MANUFACTURING COMPANIES.

KANSAS CITY, MO.—The American Electric Equipment Company has been incorporated with a capital of $2,500.

TERRE HAUTE, IND.—The McCracken Bank Protective and Electric Fire Alarm Company has incorporated to build and equip a plant to manufacture an electric protective and alarm system. James H. McCracken is president. S.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

GLEN FLORA, WIS.—The Hawkins Telephone Company proposes to install a line here.

FOSSTON, MINN.—The Garden Valley Telephone Company has been granted a franchise in this city.

GIBSON, OKLA.—The Simms-Renner Telephone Company has been incorporated with a capital of $5,000.

KEARNEY, NEB.—The Union Valley Telephone Company has been incorporated with a capital of $5,000.

LACEY, OKLA.—The Lacey & Western Telephone Company has been incorporated with a capital of $3,000.

ROSEDALE, IND.—The Rosedale Mutual Telephone Company has been incorporated with a capital of $10,000.

WAYSIDE, WIS.—The Wayside Telephone Company has increased its capital stock from $2,000 to $10,000.

NORTON, N. D.—The Norton Telephone Company has increased its capital stock from $10,000 to $30,000.

HOBART, OKLA.—The Southern Rural Telephone Company has been incorporated by Chas. F. Nailer and others.

TALOGA, OKLA.—The Taloga & Dewey County Telephone Company has been incorporated with a capital of $5,000.

THREE FORKS, MONT.—The Three Forks Telephone Company has been incorporated by J. J. Russell and others with $2,500 capital.

LITTLE ROCK, ARK.—The Earle & Tyronza Telegraph and Telephone Company has received authority to increase its capital stock from $10,000 to $32,000.

ALTON, N. H.—The Home Telephone and Telegraph Company of Alton has filed articles of incorporation with the secretary of state. The capital stock is $5,000.

MILWAUKEE, WIS.—At the recent annual meeting of the Wisconsin Telephone Company the former directors were re-elected. The business of the past year was excellent.

LOVINGSTON, VA.—The Central Telephone Company has been incorporated with $5,000 capital stock. F. M. Horsey is president, J. C. Clarkson, vice-president, and E. Carter, secretary.

CORTLAND, NEB.—The Highland Telephone Company has been incorporated with a capital of $21,000. M. M. Stanley, president; Thomas Sargent, vice-president; T. W. Sargent, secretary, and J. P. Clough, treasurer. C.

MONTREAL, QUE.—The Bell Telephone of Canada has set aside $1,000,000 for extensions and improvements during 1909. The most important extensions are to be made along the new Canadian Pacific lines in Ontario from Sudbury to Toronto.

IOWA FALLS, IOWA—The Iowa Falls & Owasa Telephone Company has been organized with a capital stock of $2,450. The directors are: J. M. Rankin, John Robertson, J. Brewster, John Hilmer, George Pemberton, John Melinger and George Melinger.

SCHAEFFERSTOWN, PA.—The Schaefferstown Telephone Company has incorporated with a capital of $5,000 to operate in Lebanon County. Many of the rural lines have been already constructed. S. H. Bomberger is treasurer of the company.

ISLE LA MOTTE, VT.—The Isle La Motte Telephone Company has filed articles of incorporation with the secretary of state at Montpelier for maintaining telephone lines in Grand Isle, South and North Hero, Isle La Motte and Alburg. The capital stock is $5,000.

SAN FRANCISCO, CAL.—The Postal Telegraph Company, which took over the Nevada Telephone and Telegraph Company, has applied for a franchise to construct a telegraph and telephone line from Reno, Nev., to Ely, Nev., via Carson City, Dayton, Fort Churchill, Goldfield and Tonopah. A.

BERKELEY, CAL.—The Pacific States Telephone and Telegraph Company has commenced extensive improvements in this city, and will in the next year expend at least $75,000 in running additional lines to take care of the fast-growing business which is accruing to the company in this city.

INDIANAPOLIS, IND.—The Indianapolis Telephone Company has filed a guarantee bond with the City Comptroller that the company will make improvements worth $500,000 during the next three years, $250,000 to be so expended during the next eighteen months. A new switchboard will be among the new equipment installed. S.

CHICAGO, ILL.—On March 22 the Chicago City Council passed a twenty-year franchise for the People's Mutual Telegraph Company, which plans to build a low-rate telegraph line to St. Louis and Kansas City. A number of Board of Trade interests are backing the project. The franchise permits the lines to be strung from the Board of Trade Building to and along the Metropolitan elevated structure to the western city limits. Overhead lines will be run from this point to Joliet, Ill., where connection will be made with the lines of the independent telephone companies, which will be used the rest of the way.

NEWARK, N. J.—The Court of Errors and Appeals of New Jersey has confirmed the order issued April 9, 1908, by the Court of Chancery, appointing Fred T. Johnson, of Newark, receiver for the United States Independent Telephone Company.

WEBSTER CITY, IOWA—Farmers adjacent to Blairsburg Township have organized the Air Line Telephone Company, with G. D. Berogan, as president; C. F. Brown, vice-president; Irving Lascher, secretary, and John Butler, treasurer. Orders have been placed for material to construct a line to Webster City. C.

DES MOINES, IOWA—The Iowa Telephone Company elected G. E. Yost, president; G. E. McFarland, vice-president and general manager; James B. Mason, secretary and treasurer; E. Palm, auditor; C. E. Hall, general superintendent. The company will expend one million dollars in repairs and extensions of its lines during the coming year. C.

EUREKA, CAL.—Work is soon to be commenced on the telephone line connecting the Hoopa Indian reservation with Korbel. A line now exists between this city and Korbel, and by completing this new line the reservation will be connected with this city. Superintendent Mortsolf, of the reservation, is now busy completing the plans.

SANPETE, UTAH—The Gunnison Telephone Company, of Sanpete County, has been organized with a capital of $5,000, divided into $2.50 shares, fully paid up by the citizens of Gunnison, Centerfield and Fayette, the places to be connected by the lines. The officers are: T. F. Kearns, president; Leo M. Gledhill, vice-president; Joseph Christensen, secretary and treasurer.

BOSTON, MASS.—It is reported that the Boston & Maine Railroad will put a system of train dispatching by telephone into use on the Fitchburg division of its lines. Superintendent of Telegraph S. A. D. Forristall has ordered the equipment for the fifty miles between Boston and Fitchburg. If the system works as successfully as it has on so many of the western railroads, it will be extended over all of the company's lines.

KAUKAUNA, WIS.—The South Greenville Farmers' Telephone Company has been organized with the following officers: President, Louis Pringle; secretary, J. H. Schneider; treasurer, A. G. Mass. This is the second company that has been organized in Outagamie County within a fortnight. There are twenty-two stockholders and the line will be six miles long, connecting with the Wisconsin Telephone Company at Appleton.

INDIANAPOLIS, IND.—Judge Parr, in the Boone Circuit Court, has just delivered the final blow to the suit against the Indianapolis Telephone Company and the New Long Distance Telephone Company by sustaining a demurrer to the amended complaint filed by the state, thus ending the efforts of Prosecutor Hooton of Marion County to annul the charters of the companies and to have receivers appointed to take charge of their affairs. This completes the victory of the companies.

ENGINEERING SOCIETIES.

CHICAGO ELECTRIC CLUB—At the weekly meeting of the Chicago Electric Club, held in the grill room of the Chicago Automobile Club on Wednesday, March 17, George Landis Wilson, of the F. Cortez Wilson Company, addressed the club on "Cost and Selling."

NATIONAL ASSOCIATION OF STATIONARY ENGINEERS—On March 16 A. L. Eustice, illuminating engineer of the Nernst Lamp Company, delivered an address on "Modern Illumination" before a gathering of the National Association of Stationary Engineers at Duluth, Minn. The address was illustrated with numerous lantern slides, showing the performance of various illuminating units and a great number of commercial installations. There was an attendance of over 200.

ELECTRIC RAILWAYS, UNIVERSITY OF MINNESOTA—The department of electrical engineering has arranged a series of lectures on "Electric Traction for Railway Trains," by Edward P. Burch, consulting engineer, Minneapolis, these being divided as follows: History of Electric Traction; Advantages of Electric Traction; Characteristics of Steam Locomotives; Characteristics of Electric Locomotives; Motor Car Trains; Electric Railway Motors; Power Required for Trains; Steam, Gas and Water Power Plants; The Transmission System; Electrification of Railroads.

OBITUARY.

COL. D. H. GARRETT, for the past seven or eight years manager of the Philadelphia office of the Columbia Incandescent Lamp Company, died in Philadelphia Friday afternoon, March 19, after a long illness. Colonel Garrett had been very well and popularly known throughout the territory which he covered, and his death will be genuinely felt by a large number of friends.

ELECTRICAL SECURITIES.

The opening of Congress, introduction of the tariff bill, President Taft's brief message and the promise of heightened business activity failed to rouse the stock market out of its rut of indifference. Popular speculative interest has been hard to attract and on the whole last week's developments were of a disappointing variety.

Dividends have been declared upon the following electrical securities: Springfield Light, Heat and Power Company; an initial dividend of one per cent upon the $1,000,000 capital stock, payable April 10 to stock of record March 30. Wilkesbarre Gas and Electric Company; the regular quarterly dividend of one per cent, payable April 1 to stock of record March 22. United Gas Improvement Company; quarterly dividend of two per cent ($1 per share), payable April 15, 1909, to stockholders of record at the close of business March 31. Electric Boat Company; the regular quarterly dividend of two per cent on the preferred stock, payable April 1, to stock of record March 20. A quarterly dividend of one per cent on the common stock of the San Diego Consolidated Gas and Electric Company, payable on March 15 to stockholders of record of March 10. Bell Telephone Company of Canada; the regular quarterly dividend of $2 per share, payable April 15 to stock of record March 25. Butte Electric and Power Company; the regular quarterly dividend of one-and-one-half per cent on the common stock, payable April 1 to stock of record March 20, and the regular quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable May 1 to stock of record April 15. Tri-City Railway and Light Company; the regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable April 1 to stock of record of March 23. Twin City Rapid Transit Company; the regular quarterly dividend of one-and-three-fourths per cent on the preferred stock, payable April 1 to stock of record March 19. Ridge Avenue Passenger Railway Company; the regular quarterly dividend of $2 per share, payable April 1 to stock of record March 15. Germantown Passenger Railway Company; the regular quarterly dividend of $1.31¼ per share, payable April 6 to stock of record March 18. American Cities Railway and Light Company; the regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable April 1. United Railways of St. Louis; the regular quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable April 10. Columbus Railway and Light Company; a dividend of one-half of one per cent, payable April 1 to stock of record March 16. Cumberland Telephone and Telegraph Company; the regular quarterly dividend of two per cent, payable April 1 to stock of record March 20. Springfield Railway and Light Company; the regular quarterly dividend of one per cent, payable April 1 to stock of record March 19. Washington Water Power Company; the regular quarterly dividend of one-and-three-fourths per cent, payable April 1 to stock of record March 20. United Traction and Electric Company; a dividend of one-and-one-quarter per cent, payable to the registered holders on the first day of April. The regular quarterly dividend of one-and-one-half per cent on the preferred stock of the Duluth Edison Electric Company, for the quarter ending February 28, payable on the first day of April. American Telephone and Telegraph Company; a dividend of $2 per share, payable April 15 to stockholders of record at the close of business on Wednesday, March 31.

ELECTRICAL SECURITIES FOR THE WEEK ENDED MARCH 20.

New York:	*Closing.*
Allis-Chalmers common	13
Allis-Chalmers preferred	41
American Tel. and Tel. Company	129½
Brooklyn Rapid Transit	71⅜
General Electric	153½
Interborough-Metropolitan common	13¾
Interborough-Metropolitan preferred	41¼
Kings County Electric	125
Mackay Companies (Postal Telegraph and Cable) common	71½
Mackay Companies (Postal Telegraph and Cable) preferred	70½
Manhattan Elevated	142
Metropolitan Street Railway	21
New York and New Jersey Telephone	110
Western Union	65
Westinghouse Manufacturing Company	78

The Western Union Telegraph Company has decided to close its four-per-cent mortgage covering an issue of $25,000,000 of bonds. Of these bonds $10,000,000 are now outstanding, so that there will be no further issue. The $10,000,000 bonds were subscribed for by stockholders at eighty-seven-and-one-half in December, 1906. They are secured by deposit of $9,733,100 New York Telephone stock and are convertible into stock at par between January 1, 1909, and January 2, 1919.

Boston:	*Closing.*
Edison Electric Illuminating	253
Massachusetts Electric	69½
New England Telephone	133½
Western Telephone and Telegraph pref.	80

The Western Telephone and Telegraph stockholders re-elected the retiring directors at the annual meeting. The net earnings for the year were $2,201,659, and the balance after charges, $829,409, out of which $800,000 was paid in dividends.

A trustee of the Massachusetts Electric Companies says: "Massachusetts Electric and its subsidiaries are in the best shape they ever have been, and from now on conditions should steadily improve. Our earnings are showing steady increases, a reflection of the improved industrial conditions along our lines.

"We have $200,000 in outside funds, which does not appear in our assets; namely, our snow and accident funds, both of which amount to $100,000 each.

"I have every confidence that our preferred stock will go upon a four-per-cent dividend basis next July, and that a year from that time, when our notes become due, we will be able to not only refinance these notes, but at the same time finance our seventeen-per-cent back dividends."

Philadelphia:	*Closing.*
Electric Company of America	12
Electric Storage Battery common	46
Electric Storage Battery preferred	46
Philadelphia Electric	11⅝
Philadelphia Rapid Transit	27⅝
United Gas Improvement	90⅛
Chicago:	*Closing.*
Chicago Telephone	132
Commonwealth Edison	111½
Metropolitan Elevated preferred	46
National Carbon common	85
National Carbon preferred	119

NEW PUBLICATIONS.

INDUSTRIAL ENGINEERING—The Rochester Electric Motor Company, Rochester, N. J., has reprinted the paper presented at the meeting of the Rochester Engineering Society, January 18, entitled "Industrial Engineering," by Henry W. Peck.

NEW YORK SUBWAY DATA—The Public Service Commission for the First District of New York State has published the report of Bion J. Arnold on "The Return of the Investment in the Subway of the Interborough Rapid Transit Company of New York City." This embodies Report No. 7. Report No. 5, dated August 15, 1908, by Bion J. Arnold, includes full data on the "Cooling and the Ventilation of the Subway of the Interborough Rapid Transit Company of New York City."

DATES AHEAD.

Worcester Mechanical and Electric Exposition. Mechanics' Hall, Worcester, Mass., March 27-April 3.

Louisville Electrical Show. The Armory, Louisville, Ky., April 12-24.

Missouri Electric Light, Gas and Railway Association. Annual convention, Springfield, Mo., April 15-17.

Iowa Electrical Association. Annual convention, Cedar Rapids, Iowa, April.

American Electrochemical Society. Next meeting, Niagara Falls, Ontario, May 6-8.

Omaha Electrical Show. Omaha Auditorium, Omaha, Neb., May 6-15.

Southwestern Electrical and Gas Association. Annual convention, Dallas, Tex., May.

Arkansas Association of Public Utility Operators. Annual meeting, Hot Springs, Ark., May 12, 13, 14.

American Association of Electric Motor Manufacturers. Annual convention, Hot Springs, Va., May 17-20.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual convention, Canton, Ohio, May 21-22.

West Virginia Independent Telephone Association. Annual convention, Parkersburg, W. Va., May 27-28.

National Electric Light Association. Annual convention, Atlantic City, N. J., June 1-4.

Association of Edison Purchasing Agents. Annual convention, Atlantic City, N. J., June 1-4.

American Railway Master Mechanics' Association. Annual convention, Atlantic City, N. J., June.

Master Car Builders' Association. Annual convention, Atlantic City, N. J., June.

Association of Railway Telegraph Superintendents, Detroit, Mich., June 23.

American Institute of Electrical Engineers. Annual convention, Thousand Islands, N. Y., June 28.

Ohio Electric Light Association. Annual convention, Toledo, July 13-15.

National Electrical Contractors' Association. Annual convention, Toledo, Ohio, July 21-23.

PERSONAL MENTION.

MR. H. B. THAYER, president of the Western Electric Company, has been elected vice-president of the American Telephone and Telegraph Company.

MR. C. O. BAKER, the well-known platinum king of the United States, with Mrs Baker, is enjoying a vacation of two months in Florida. Mr. Baker expects to return to New York early in April.

MR. H. H. CUDMORE, sales manager of the Brilliant Electric Company, Cleveland, Ohio, has been elected president and general manager. Mr. Cudmore has had a long experience in the electrical business, and is well qualified to understand the needs of the lamp buyers.

MR. W. P. WOOLLEY, secretary-treasurer of the Woolley Electric Company, St. Louis, Mo., announces that he has resigned this position and as general manager, and has given up all active connection with the company. He will manufacture the C-C Non-Gap lightning arrester under his own name.

MR. CALVIN C. GOODRICH, of Minneapolis, has been elected president of the Twin City Rapid Transit Company, to fill the vacancy caused by the death of Mr. Thomas Lowry. Mr. Willard J. Hield, of Minneapolis, has been appointed vice-president and general manager, and Mr. John R. Mitchell, of St. Paul, a director. C.

PROF. LOUIS A. HERDT, associate professor of electrical engineering at McGill University, Montreal, has been appointed to succeed Prof. R. B. Owens as occupant of the chair of electrical engineering in the same university. Professor Owens retires, owing to continued ill health.

MR. WILLIAM BARCLAY PARSONS, chief consulting engineer of the Interborough Rapid Transit Company, New York city, and who was elected a director of the Underground Electric Railways Company of London, Limited, some weeks ago, sailed last Tuesday on the Kronprinzessin Cecile to make a study of the London transportation problem.

MR. ROBERT THURSTON KENT has resigned as engineering editor of the *Iron Trade Review*, Cleveland, Ohio, to become managing editor of *Industrial Engineering*, Pittsburg, Pa., a new paper devoted to mechanical engineering subjects. Mr. Kent has been with the *Iron Trade Review* since 1905, and prior to that time was associate editor of the ELECTRICAL REVIEW, New York.

MR. L. C. NORTON, for the past five years salesman for the Bissell Electric Company of Toledo, will sail on April 25 for Buenos Ayres, Argentine Republic, where he will act as manufacturers' agent for various American industries. He has grown up in the electrical business at Toledo, Ohio, and is recognized as an authority on inside illumination. He will be accompanied by his family. H.

MR. B. E. SUNNY, president of the Chicago Telephone Company and vice-president of the General Electric Company and of the American Telephone and Telegraph Company, and Mr. Charles G. Dawes, largely interested in public-utility enterprises, have been appointed members of a special commission to standardize the duties and compensation of the employes in all departments of the City of Chicago.

MR. J. G. BOYD, for many years associated with the Columbia Incandescent Lamp Company, is now connected with the Central Electric Company, of Chicago, as manager of the lamp department. The rapid growth of the Central Electric lamp business has necessitated specialization of the work, and Mr. Boyd's long experience in the incandescent lamp field has eminently fitted him to take charge of this new department.

MR. C. P. LINDSLEY, president of the Lindsley Brothers Company, Spokane, Wash., recently spent a week in Chicago. Mr. Lindsley was on his way south on a combined business and pleasure trip, and was accompanied by Mrs. Lindsley. The Lindsley company is one of the oldest cedar pole concerns in the business, and makes a specialty of western poles. The company also operates a cross-arm mill, and is one of the largest independent cross-arm manufacturers in the country.

MR. DAVID J. EVANS has been elected president of the Andresen-Evans Company, 1501 Monadnock Block, Chicago, engineers, specializing in the installation of ore and coal handling plants and grab buckets. Mr. Evans has resigned as manager of sales for the Rail Joint Company. Mr. H. P. Andresen will continue as vice-president and chief engineer, and the company will have the benefit of his experience, covering a period of more than ten years, as an engineer in steel mill, railroad and conveying machinery work.

MR. THOMAS P. McCRAY, of Fairmont, W. Va., has been appointed representative by the Fort Wayne Electric Works, of Fort Wayne, Ind., for north central West Virginia, and will take care of all inquiries for Fort Wayne apparatus for that section. Mr. McCray is a graduate of Pratt Institute, of Brooklyn, N. Y., 1899. He has had a wide, practical experience, being for five years with the New York Telephone Company and for four years with other New York city electrical corporations. Mr. McCray's headquarters are in the McCray Building, 323 Madison Street, Fairmount, W. Va.

MR. CHARLES L. PILLSBURY, the well-known electrical engineer of Minneapolis, Minn., has moved his offices from 202 Metropolitan Life Building to suite 805-11 of the same building. Constantly increasing business made it necessary to seek larger and more commodious quarters. Mr. Pillsbury was awarded the contract for all the heating, plumbing, drainage and electrical work for the State Prison, Oak Park, Minn., the cost of which will be $2,200,000. The plant will be finished in four years. Mr. Pillsbury also has a considerable quantity of local work and has six assistant engineers in his employ.

MR. A. EUGENE MICHEL, who has for the past three years been manager of the Geo. H. Gibson Company, advertising engineers, has opened offices at 1572 Hudson Terminal Buildings, New York. Mr. Michel will in future confine his efforts as an advertising engineer to the promotion of steam specialties and apparatus, power transmission appliances and machine tools. Mr. Michel is a graduate engineer, associate member of the American Society of Mechanical Engineers, and with eleven years' advertising and engineering training, which includes practical experience in machine design, testing, etc., is well prepared to conduct the advertising of mechanical products. Among the accounts which Mr. Michel will handle are the following: The Watson-Stillman Company, the Bird-Archer Company, the Diamond Chain and Manufacturing Company and James Beggs.

MR. A. C. GRAY has been assigned by the Edison Electric Illuminating Company, of Boston, as a special agent to devote his entire time to working among garage managers, automobile manufacturers and manufacturers' agents throughout the company's territory. He will visit all the garages, giving the managers and their employes such information as they need about charging outfits and the maintenance of electric vehicles. It will be a part of Mr. Gray's work to see that present users of electric machines of all sorts know everything there is to know about the availability of charging stations; and he will also see that they are informed as to the feasibility of installing their own rectifiers and other apparatus. The Boston Edison Company has recently begun a campaign to develop public interest in the electric vehicle and this departure is a guarantee of the company's real desire to co-operate in every way to further this development.

INDUSTRIAL ITEMS.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., announces the removal of its district office in Pittsburg, Pa., to the Lewis Block, and the appointment of Ludwig Hommel as district manager.

THE H. T. PAISTE COMPANY, Philadelphia, Pa., in Bulletin 64, describes the Paiste entrance switch boxes. There is also some interesting descriptive matter concerning Paiste pipe taplets and K-W catalog numbers.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., has prepared an interesting booklet describing and illustrating its automatic intercommunicating telephones. Copies of this booklet will be furnished to those interested upon request.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., is distributing a booklet describing its "New Flexduct," with soapstoned interior. The company is preparing to mail a large number of sample pieces and a thorough inspection and test is invited.

THE CRESCENT COMPANY, 103 West Adams Street, Chicago, is distributing a bulletin illustrating "Trio" refillable enclosed fuses. The company announces that this fuse will effect a thirty-three-and-one-third-per-cent saving in maintenance. Copies will be sent to those interested upon request.

JOHN A. ROEBLING'S SONS COMPANY, Trenton, N. J., has issued a handsome and interesting booklet on the subject of "Wire, Its Manufacture and Uses," which briefly develops the history of drawn metal products down to the present excellent manufactures made in thousands of different shapes and sizes.

THE CONNECTICUT TELEPHONE AND ELECTRIC COMPANY, Meriden, Conn., in catalog No. 20, illustrates and describes a very interesting line of inter-communicating telephones for interior use. This line includes automatic, semi-automatic and manually-operated systems and appears to be complete enough to satisfy any possible requirements.

THE SPRAGUE ELECTRIC COMPANY, New York, N. Y., is sending out an attractive fan catalogue for 1909. It contains both direct and alternating-current fans for desk, wall, ceiling, floor and counter column uses. Special attention is called to the new direct-current oscillating desk and bracket fan, on account of its simplicity and durability, and also to the fact that the oscillator mechanism can readily be attached to Lundell non oscillating fans of the 1909 type.

THE WESTERN ELECTRICAL COMPANY, Omaha, Neb., announces that hereafter its business will be known as the Johnston Electric Company, with headquarters at 411-413 South Tenth Street. President G. W. Johnston announces that there will be no change in the business or personnel of the company and that the reason for making the change is that there has been considerable confusion due to the establishment of an

Omaha branch by the Western Electric Company of Chicago. While there is little similarity in the business of the two companies, the confusion of names has caused many delays and annoyances. Mr. Johnston has conducted an electrical supply business in Omaha under the name of the Western Electrical Company for the last twenty years.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, is distributing to a large number of supply companies and central stations complete stocks of oscillating, desk, bracket, ceiling and exhaust fans for direct and alternating current. These lines are proving exceptionally good sellers. Booklets will be sent upon request to 1319-1419 Lagonda Avenue.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) March 16, 1909.

915,063. BATTERY PLATE. Claude W. Bender, Altoona, Pa., assignor of one-half to J. Richard Sloan, Altoona, Pa. Filed April 18, 1908. Has a surface shaped by repeated rolling pressures alternately in reverse directions at such angles as to work the metal without disrupting it.

915,070. SHIRT-NECKBAND IRON. Louis H. Bowersox, Minneapolis, Minn. Filed March 5, 1908. Comprises a base portion having a handle and electrical heating means and oppositely-curved grooves to receive the upper edge of the neckband.

915,071. TRANSPORTATION SYSTEM. William C. Carr, Buffalo, N. Y. Filed June 12, 1908. A telpherage system is provided with a track composed of inverted channel-formed rails and a suspended car, having wheels on the top of the rails and trolley wheels projecting into the groove and against the under surface of the rails.

915,075. SIGNALING SYSTEM. Nathaniel B. Cregier, Chicago, Ill. Filed March 16, 1904. The central telephone-exchange switchboard has a map of its territory and a visual signal for each substation on the map.

915,077. DESK STAND. William W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed January 6, 1904. An arm extends downward through the tubular standard and has its lower end adapted to actuate a set of switch springs enclosed by the base so that their contacts are visible from beneath.

915,079. TELEPHONE RECEIVER. James Dixon, Cleveland, Ohio. Filed November 23, 1908. At one side of the opening is a lug arranged to be pressed against the bony structure of the head and close to the ear.

915,081. RAILWAY TRAFFIC-CONTROLLING APPARATUS. Frank L. Dodgson and Winthrop K. Howe, Rochester, N. Y., assignors to General Railway Signal Company, Rochester, N. Y. Filed August 28, 1908. Consists of rail-switch mechanisms with an electric lock for each connected in parallel between two conductors, a lock-circuit controller in each feed wire, and means for breaking the branch circuit to each lock mechanism by a track-circuit mechanism.

915,112. ELECTRIC AND PNEUMATIC GOVERNOR. William K. Rankin, Philadelphia, Pa., assignor to John E. Reyburn, Philadelphia, Pa. Filed May 22, 1907. Renewed August 6, 1908. A fluid-pressure diaphragm has a switch blade and electrical connections thereto, a terminal adapted for engagement by the blade and a shaft whereto the blade is attached and having an arm co-operating with the blade.

915,135. INCANDESCENT ELECTRIC LAMP SOCKET. August Weber, Sr., Schenectady, N. Y., assignor to Weber Electric Company, Schenectady, N. Y. Filed October 1, 1906. Comprises an insulating base, a switch block, a screw shell mounted upon the base and having a continuous introverted end flange.

915,152. TROLLEY POLE. George T. Barr, Sr., Waco, Tex., assignor of one-half to Henry C. Blandford, Memphis, Tenn. Filed August 3, 1908. The pole has upper and lower tubular telescoping sections with a coil spring in the lower section and an operating cord attached to the upper section and extending through the coil spring to a winding drum.

915,154. TELAUTOGRAPH. Edouard Belin, Paris, France. Filed January 17, 1908. Comprises a stylus brought successively into contact with different parts of the representation to be transmitted, means controlled by the movement of the stylus due to variations in the relief of the object varying the resistance of the circuit, and means for transmitting the current variations into variations of light intensity, which are recorded.

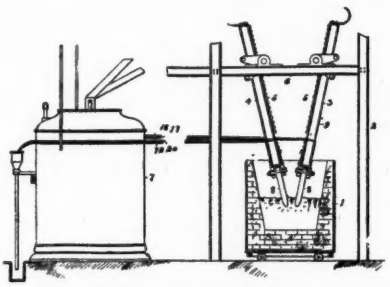
915,171. ELECTRIC AERIAL AMBULATING SYSTEM. Ernest F. George, Manlius, N. Y. Filed September 24, 1907. Comprises a number of electromagnets arranged side by side and means for progressively energizing the magnets in groups, in combination with an armature movable by the operator within the magnetic field from magnet to magnet.

915,172. MANUFACTURE OF ALLOYS OF SILICON. Hans Goldschmidt, Essen-on-the-Ruhr, Germany. Filed April 24, 1908. The process for producing an alloy of silicon with calcium consists in heating silicon with lime in the proportions of one to two in an electric furnace in the presence of a flux composed of fluorspar and calcium chloride.

915,178. ELECTRIC FAN AIR SPREADER. Newton S. Hillyard, St. Joseph, Mo. Filed July 27, 1908. Is made of a single sheet of closely-perforated metal bent into cone shape, the flattened apex adapting it to be attached to the central part of the front of the fan frame.

915,188. SAFETY APPLIANCE FOR RAILWAYS. Charles J. Kintner, New York, N. Y. Filed April 14, 1903. Renewed January 25, 1904. The signal is operatively connected to a differential electromotive device having one of its circuits permanently closed and the other normally open and connected to an insulated section of one of the service rails on one side and to the other rail on the other side.

915,189. SAFETY SYSTEM FOR ELECTRIC RAILWAYS. Charles J. Kintner, New York, N. Y. Filed January 26, 1903. Renewed May 9, 1905. A switching device is carried by each car for automatically disconnecting its motor from the source of power, semaphore arms being located at intervals beside the track for automatically actuating the switching devices.



915,668.—WATER-COOLED ELECTRODES FOR ELECTRIC FURNACE.

915,190. RAILWAY SIGNAL. Charles J. Kintner, New York, N. Y. Filed July 20, 1903. Provides a home and a distant signal for each block, both made simultaneously operative solely by the presence of a car upon the service rails.

915,193. TROLLEY CATCHER. George W. Kramer and Alfred G. Hague, Des Moines, Iowa. Filed July 31, 1903. A plate fixed to one side of the trolley pole has laterally projecting arms at its upper end, their inner ends being between the centre and upper edge of the trolley wheel.

915,197. VIBRATORY MASSAGE APPARATUS. Carl O. Lindstrom, Chicago, Ill. Filed October 30, 1908. An electric vibrator is provided with a clamp for securing it to a chair.

915,237. ELECTRIC SIGNALING SYSTEM. Howell W. Souder, Tamaqua, Pa., assignor of one-fourth to Ellen Z. Breed, Cleveland, Ohio, and one-fourth to Marie Z. Bradshaw, Conshohocken, Pa. Filed June 10, 1907. Includes a signal lantern for electric railways comprising an electric lamp in a casing, a pivoted shutter normally dropped before the lamp and an electromagnet armature normally resting on the shutter so as to swing it away from the front of the lamp.

915,238. ELECTRIC ROAD-CROSSING SIGNAL. Howell W. Souder, Tamaqua, Pa., assignor of one-fourth to Ellen Z. Breed, Cleveland, Ohio, and one-fourth to Marie Z. Bradshaw, Conshohocken, Pa. Filed June 29, 1907. Contains a normally open circuit, an electrically-operated signal, a second circuit closed by a passing car, and means operated by the second circuit to close the signal circuit.

915,246. AUTOMATIC ACCELERATING CONTROLLER. Harry F. Stratton, Cleveland, Ohio, assignor to the Electric Con-

troller and Manufacturing Company, Cleveland, Ohio. Filed July 7, 1908. A relay directly responsive to the acceleration of the car governs the accelerating means, this relay being adapted to give slower than normal acceleration on up grades and faster than normal acceleration on down grades.

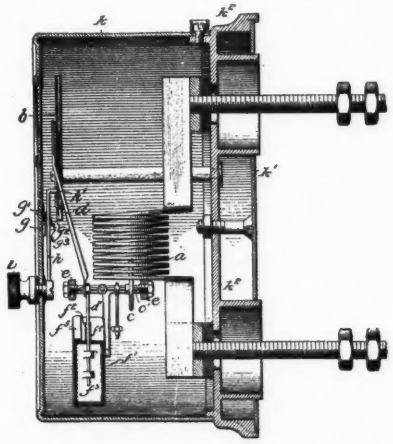
915,249. APPARATUS FOR WELDING BY ELECTRICITY. Charles E. Thompson, Cleveland, Ohio, assignor to the Electric Welding Products Company, Cleveland, Ohio. Filed June 11, 1907. The apparatus consists of a fixed and a reciprocable electrode forming the terminals of the electric heating circuit, clamping dies embracing the parts to be welded, and the means for forcing them together.

915,257. ELECTRICAL MEASURING INSTRUMENT. Carl Wiler, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. Filed September 10, 1906. An ammeter is provided with a flat solenoid coil, an elliptical magnetic vane pivoted at about a central position with respect to the lower opening in the coil, an indicator needle moved by the vane and a dash pot for rendering the needle dead beat.

915,280. ELECTRIC SIGNALING. Reginald A. Fessenden, Washington, D. C. Filed February 8, 1907. A receiver for wireless telegraphy comprises a discharge tube containing rarefied gas with several paths therethrough, means operated by the waves to shift the paths of discharge, and means for affecting a selenium cell in a local circuit.

915,288. LAMP-CORD ADJUSTER. William Hagstrom, Emanuel Hagstrom and Gustaf Hagstrom, Lindsborg, Kan., assignors to Hagstrom Brothers Manufacturing Company, Lindsborg, Kan. Filed July 22, 1907. Contains a reel and a coiled spring therefor.

915,290. CONTROL SYSTEM FOR ELECTRIC HOISTS. Jay H. Hall and James F. Schnabel, New York, N. Y., assignors to



915,257.—MAGNETIC-VANE AMMETER.

the Electric Controller and Manufacturing Company, Cleveland, Ohio. Filed August 10, 1908. A magnetic brake has its releasing winding normally in series with the motor; the controller is arranged to connect the field windings of the motor and the brake winding in a circuit containing resistance and to connect the armature in another circuit with resistance.

915,292. APPARATUS FOR BONDING RAILS. Albert B. Herrick, Cleveland, Ohio, assignor to the Electric Railway Improvement Company, Cleveland, Ohio. Filed December 17, 1904. Describes an adjustable frame for holding the tools of an electric-welding outfit mounted on a car.

915,305. TELEPHONE POLE. Eugene J. Newhall, Waupaca, Wis. Filed June 13, 1908. Transverse braces are secured to the pole and longitudinal stiffening guys to the braces.

915,311. ELECTRIC VEHICLE AND CABLE REEL. Frank L. Sessions, Columbus, Ohio, assignor to the Jeffrey Manufacturing Company. Filed March 24, 1903. Renewed June 18, 1906. An electric mining locomotive is provided with a power-driven reel for winding or unwinding cable.

915,328. STORAGE-BATTERY JAR. Chester W. Bentley, Binghamton, N. Y. Filed June 19, 1908. Through the cover of the jar threaded cell terminals pass and are sealed. Connectors are bolted directly to the exposed tops of the terminal.

915,330. INSULATOR AND WIRE CLAMP. Jasper Blackburn, St. Louis, Mo. Filed March 2, 1908. In the upper portion is formed a notch V-shaped in cross-section and which follows a compound curve across the insulator, the ends of the notch being undercut.

915,334. HARMONIC RINGER. Merritt S. Conner, Rochester, N. Y., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Filed August 13, 1906. The armature is of relatively great mass suitably disposed and adjusted to produce the desired moment of inertia, such adjustment together with that of the strength of the spring causing the ringer to be responsive only to current of a certain frequency.

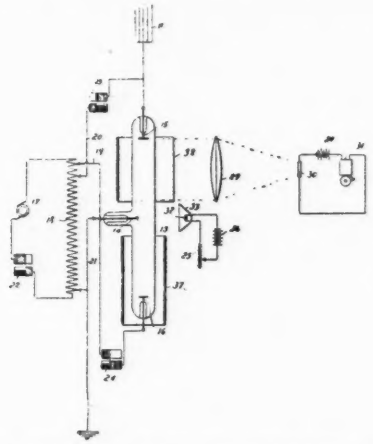
915,339. VENTED STOPPER FOR STORAGE-BATTERY JARS. Bruce Ford, Philadelphia, Pa. Filed June 4, 1907. A tubular casing contains a detachable stopper consisting of a hollow cone perforated at its apex and having in the wall perforations near its base.

915,348. OVERFLOW ALARM. Julius A. A. Heydegger, Newark, N. J. Filed October 31, 1908. A float connected with a movable contact member is adapted to close an alarm circuit.

915,375. INSULATING THIRD-RAIL SUPPORT. Daniel M. Pfautz and John L. Luckenbach, Philadelphia, Pa., assignors to the American Suspension Railway Company, Philadelphia, Pa. Filed June 29, 1908. An inverted and suspended third rail is secured to an insulating block by means of an eye-bolt and hanger clamps.

915,381. OUTLET BOX. George Pullets, New York, N. Y. Filed April 24, 1907. A space-closing element between an outlet box and a face plate consists of a spring formed of coiled resilient, flat material having the edges of the coil facing the face plate and box.

915,388. CIRCUIT CONTROLLER FOR EXPLOSION ENGINES. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Filed July 7, 1906. A longitudinally movable sleeve on a shaft is adapted to affect the primary ignition circuit.



915,280.—WIRELESS TELEGRAPH RECEIVING STATION.

915,389. IGNITION SYSTEM FOR EXPLOSION ENGINES. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Filed December 1, 1906. A vibrating part is positively impelled by a cam to break the primary circuit of an induction coil.

915,390. IGNITION SYSTEM FOR EXPLOSION ENGINES. Richard Varley, Englewood, N. J., assignor to Varley Duplex Magnet Company. Filed May 10, 1907. Includes an induction coil whose primary circuit is intermittently broken and a number of auxiliary induction coils with means for successively connecting their primaries to the secondary of the first coil.

915,391. IGNITION SYSTEM FOR EXPLOSION ENGINES. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Filed June 4, 1908. A rotary contact member for the primary circuits of a set of spark coils.

915,406. INSULATOR. Samuel Bartley and William O. Bartley, Calhoun, Ill. Filed June 17, 1908. Comprises a sectional casing, insulation disposed within the sections, and means for securing a circulation of air between the meeting faces of the sections of the insulation.

915,438. ELECTROMAGNETIC APPARATUS FOR RECIPROCATING MACHINE TOOLS AND THE LIKE. Harry A. Hornor, Riverton, N. J. Filed August 17, 1907. Comprises a frame, an armature located in a recess therein, and electromagnet coils on opposite sides of the recess and a switch for alternately energizing the magnet coils.

915,465. GLOVE STRETCHER. Charles L. McBride, Toledo, O. Filed August 20, 1906. Independent electric conductors are disposed in the cavities of the hand portions and the finger

portions of each plate and suitable resistances are provided for heating the plates.

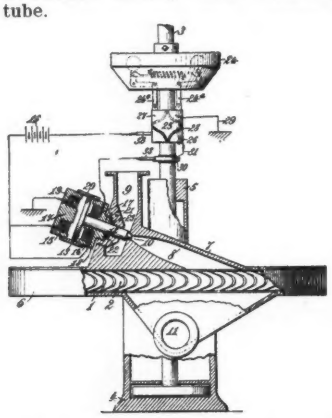
915,485. SPARK PLUG. Emil Santsche, Eureka, Cal., assignor of three-eighths to John A. Prentice and two-eighths to Charles M. Wheeler, Eureka, Cal. Filed May 4, 1908. Is provided with a fixed electric contact and an oscillatory pin mounted in a shaft and carrying a contact disposed to wipe the fixed contact.

915,488. FURNACE FOR THE TREATMENT OF METALS. Wilhelm Schemmann and Jegor Bronn, Rombach, Germany. Filed October 19, 1907. An electric furnace has three grooves in its hearth for the reception of metal, a cross conduit entering the grooves at one end, an electrode entering the other end of each groove and a three-phase circuit connected to the three electrodes.

915,498. SHADE HOLDER. William S. Stapley, Bridgeport, Conn., assignor to Bridgeport Brass Company, Bridgeport, Conn. Filed September 14, 1908. An incandescent lamp-shade holder has its upper and lower ends threaded and split to engage a lamp socket and shade, a threaded sleeve over each and securing the split parts in place.

915,518. TELEPHONE APPARATUS. Frank S. Weyrs, Philadelphia, Pa. Filed October 8, 1906. Renewed January 6, 1908. Again renewed August 11, 1908. A set of levers is connected to a switch hook and supports the receiver in an elevated position.

915,526. ELECTRIC-ARC STEAM GENERATOR. William W. Wonner, York, Pa., assignor of one-half to Mearl E. Kunkel, Rossville, Pa. Filed May 25, 1908. A heater having a tube through it is provided with electrode holders at opposite ends and electrodes having their co-acting ends located within the tube.



915,716.—ELECTRO-MECHANICAL GOVERNOR FOR STEAM TURBINES.

915,578. MACHINE FOR RECORDING TELEPHONE CALLS. Hermann Fascher, San Diego, Cal. Filed July 24, 1906. The recording instrument has a counting and a printing mechanism, the transmitter instrument having a transmitter wheel with two independent series of contact points, one adapted to actuate the counting mechanism and the other to operate the printing mechanism.

915,582. ELECTRO-THERMOSTATIC REGULATOR. Theron W. Fothergill, Berlin Mills, N. H., assignor of one-half to Bradley Reed, Berlin Mills, N. H. Filed April 28, 1908. The thermostat controls the circuits of two electromagnets that govern the valves.

915,592. TELEPHONIC EXCHANGE SWITCHBOARD. Edward A. Graham, Brockley, London, England, assignor to himself and Alfred Graham and Company, Brockley, London, England. Filed June 21, 1907. A weather-resisting telephone-exchange switchboard comprises a casing having central, upper and lower chambers, and means for closing the chambers in a water-tight manner, holes being provided through which jack plugs can be inserted and glazed openings arranged opposite the lamps.

915,597. FLOOR SANDER. John G. Henderson, Chicago, Ill. Filed June 8, 1906. The machine is motor driven.

915,625. TELEPHONE RECEIVER. Alcorn Rector, New York, N. Y., assignor to Rector Help-A-Phone Company, New York, N. Y. Filed March 13, 1908. A ring is interposed between the end of the receiver and its ordinary ear-piece, the ring having a central sound bore corresponding with the bore of the ear-piece.

915,639. IGNITION SYSTEM FOR EXPLOSION ENGINES. Richard Varley, Englewood, N. J., assignor to The Autocoil Company. Original application filed December 1, 1906. Divided and this application filed June 4, 1908. This is a modification No. 915,389.

915,657. INCANDESCENT BODY FOR ELECTRIC GLOW LAMPS. Werner V. Bolton, Charlottenburg, Germany, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Original application filed May 31, 1902. Divided and this application filed July 10, 1905. Consists of a substantially homogeneous mixture of metallic tantalum intimately mingled with carbide of tantalum.

915,666. PROCESS FOR PRODUCING PRINTING SURFACES. Ozias Dodge, Norwich, Conn. Filed February 19, 1904. Consists in producing a picture on the surface of the plate by photography and building up the surface of the plate upon the photographed lines by electrolytic action, thus forming either an intaglio or relief printing plate.

915,667. ELECTRICALLY-PROPELLED ROAD VEHICLE. Henry Ducasse, Paris, France, assignor to Société Anonyme L. Electrique, Paris, France. Filed December 31, 1904. Relates to the spring suspension for the motor.

915,668. WATER-COOLED ELECTRO-CARBON CONNECTION FOR ELECTRIC FURNACES. Charles A. Duncan, Duluth, Minn. Filed October 5, 1908. A water-cooled electrode comprises a stationary jaw and a movable jaw hinged thereto, the jaws having water-cooling means.

915,671. ELECTRICALLY-CONTROLLED FEED MECHANISM. Bengt M. W. Hanson, Hartford, Conn., assignor to Pratt & Whitney Company, Hartford, Conn. Original applications filed February 28, 1906, and October 13, 1906. Divided and this application filed March 11, 1908. Consists of a reducing tool, an adjustable device provided with a feeler for engaging the work, a plug connected by wire with the adjustable device, a row of electrically-connected sockets spaced from each other and adapted to interchangeably receive the plug and a circuit, including the plug, wire and sockets and circuit-controlling means governed by the feeler.

915,700. TROLLEY SWITCH. John J. Ruddick, Newton, Mass. Filed May 28, 1908. In combination with a trip is a contact member and an initial member interposed between the trip and contact member and yieldingly connected to the trip.

915,716. GOVERNOR FOR ELASTIC TURBINES. James Wilkinson, Birmingham, Ala., assignor to The Wilkinson Steam Turbine Company. Filed December 22, 1902. Electrical means are provided to open and close the nozzle and a governor periodically actuates this means and opens the nozzle for periods varying with the load.

915,719. ELECTRIC CONTROLLER. William P. Cosper, Chicago, Ill., assignor to Lord Electric Company, Boston, Mass. Filed June 27, 1907. Combined with a rotatable cover is a pendulum adapted to intermittently block forward movement thereof, thus necessitating a timed release.

915,720. CONTROLLER REGULATOR. William P. Cosper and Walter J. O. Johnson, Chicago, Ill., assignors to Lord Electric Company, Boston, Mass. Filed December 21, 1907. This is a modification of the above.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 23, 1909:

471,100. ELECTRICALLY-CONTROLLED ELEVATOR. A. M. Coyle, Washington, D. C.

471,155. ALTERNATING-CURRENT MOTOR. E. Thomson, Swampscott, Mass.

471,210. ELECTRIC STRIKING-MECHANISM FOR CLOCKS. S. C. Dickinson, Corning, Iowa.

471,230. ELECTRIC RAILWAY SIGNAL. E. C. Wiley, Bristol, Tenn.

471,234. ELECTRIC ARC LAMP. H. Dewar, Boston, Mass.

471,242. ELECTRICALLY WELDING METALS. A. De Meritens, Paris, France.

471,271. ELECTRIC SWITCH. A. Metzger, New York, N. Y.

471,296. ELECTRIC SIGNAL FOR RAILWAYS. E. T. Turney, Chicago, Ill.

471,302. SAFETY DEVICE FOR ELECTRICAL CONDUCTORS. J. Marx, Nauheim, Germany.

471,352. TELEPHONE SYSTEM. A. B. Ferdinand, Oshkosh, Wis.

471,409. APPARATUS FOR ELECTRIC RAILWAY SIGNALING. A. J. Wilson, Port Chester, N. Y.

471,410. ELECTRIC RAILWAY-SIGNALING APPARATUS. A. J. Wilson, Port Chester, N. Y.

471,526. DISC CARBON FOR ARC LIGHTS. H. W. Libbey, Boston, Mass.

471,527. MACHINE FOR CASTING GRIDS FOR SECONDARY BATTERIES. A. F. Madden, Newark, N. J.